The Glass Industry

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Vol. 5 AUGUST, 1924 No. 8

Power and Methods of Drive for Plate Glass Grinding and Polishing Tables

By C. W. Fick*

The manufacture of plate glass requires more power than any other branch of the glass industry. That the total power consumption is comparable with some of the most important industries is indicated by the following figures. Each square foot of finished plate glass has required from 3 to 3½ kilowatt-hours for its production. The output of some of our largest plants is 15,000,000 square feet per year. The annual power requirement in such a plant is, therefore, approximately fifty million kilowatt-hours, and means on a 280 day per year basis, an average load of 7,500 kilowatts. This figure does not include any electric energy that may be used for process heating.

The grinding and polishing machinery forms 80 per cent of this load. Therefore, in a 15,000,000 square foot plant the average grinding and polishing load is 6,000 kilowatts.

The Process

The glass emerges from the annealing oven or lehr in sheets approximately 16 feet by 18 feet and with a surface so rough as to be almost opaque. One sheet is placed on a circular table covered with a quick drying plaster; smaller pieces from broken sheets are placed to cover the whole table surface and then more plaster is poured over them to fill in the open spaces and to present a smooth surface to the grinding blocks.

The table is of cast iron, 36 feet in diameter, and weighs 75 to 80 tons. Some companies employ smaller tables of 28 feet and 24 feet in diameter. Each table is mounted on flanged wheels so that it can be rolled from place to place on a track.

When the plaster has dried, the table is rolled on to a transfer car which carries it to the grinding machine. This latter consists of a circular spider mounted on a vertical shaft, driven through gear reductions as shown in Fig. 1. The table is rolled over the spider which is then raised to engage the table and locked in place. Suspended over the table are two grinding discs to the lower surface of which are bolted cast iron blocks. These discs are approximately half the table diameter. After the table is up to speed these grinding discs are lowered until the blocks touch the surface of the glass, the friction causing the discs to revolve in the same direction as the table. Some companies have found it necessary to take the roughing cut at low speed, lowering the grinders with the table revolving at one-quarter or one-half speed. Abrasive sand and water are poured over the glass as the grinding proceeds. The process requires 50 to 90 minutes, after which the table is taken to a similarly arranged polishing table where felt pads and rouge (roasted

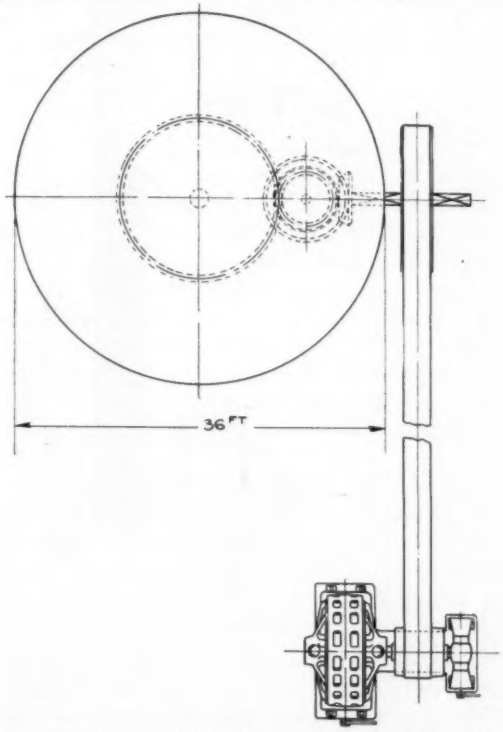

FIG. 1. BELTED MOTOR DRIVE, USING ONE SPUR GEAR AND ONE BEVEL GEAR REDUCTION. MOTOR APPROXIMATELY 450 R.P.M.

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iron sulphate) replace the cast iron blocks and sand. This completes one side of the glass, after which it is turned over on the table and the other side subjected to the same process.

Power Required for Grinding and Polishing

From the foregoing description it is seen that the load is practically all friction, varying with the abrasive used and the pressure of the grinding or polishing disc. With present practice the following motor ratings have been found suitable:

Table Diameter	Grinders, RPM	Horsepower
36 feet	20	500
28 feet	25	300
24 feet	28	200
	Polishers	
36 feet	13	700
28 feet	17	400
24 feet	22	300

Motor Types and Arrangements

The break away friction of the tables corresponds to about 20 per cent of the normal rated torque of the polisher motor

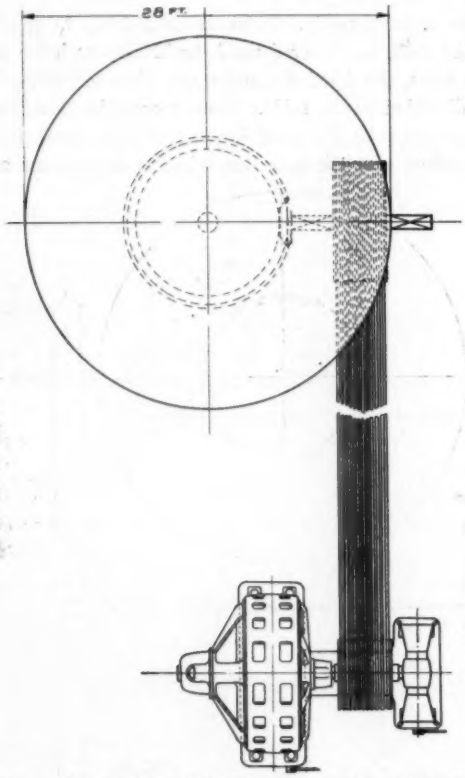


FIG. 2. ROPE DRIVE MOTOR, WITH ONE BEVEL GEAR REDUCTION

and 30 per cent of the normal rated torque of the grinder motor, and the torque drops to a lower value immediately after the table breaks away from rest. Since the speed of the table is very low, the energy required to bring it up to speed is low and any type of motor which has sufficient starting torque to overcome the break away friction will bring the table up to speed. The squirrel cage induction motor, the slip ring induction motor and the synchronous motor all meet these torque requirements. Where the first stage of grinding or polishing requires operation at partial speed, obviously the slip ring type induction motor must be used, as neither of the other types mentioned can be operated at partial speeds from a constant frequency supply.

The arrangement shown in Fig. 1 employing a belted slip ring motor is the one very frequently employed in the past. The motor belts to a shaft on which is mounted a bevel pinion meshing with a bevel gear, which in turn is mounted on a vertical shaft. On the upper portion of this vertical shaft is a spur pinion which engages a spur gear on the main shaft. The spur pinion mentioned has a face several inches wider than the gear with which it meshes to allow for the vertical movement of the main shaft and spider.

A variation of this arrangement is shown in Fig. 2, with the bevel gear on the main shaft and the bevel pinion on an

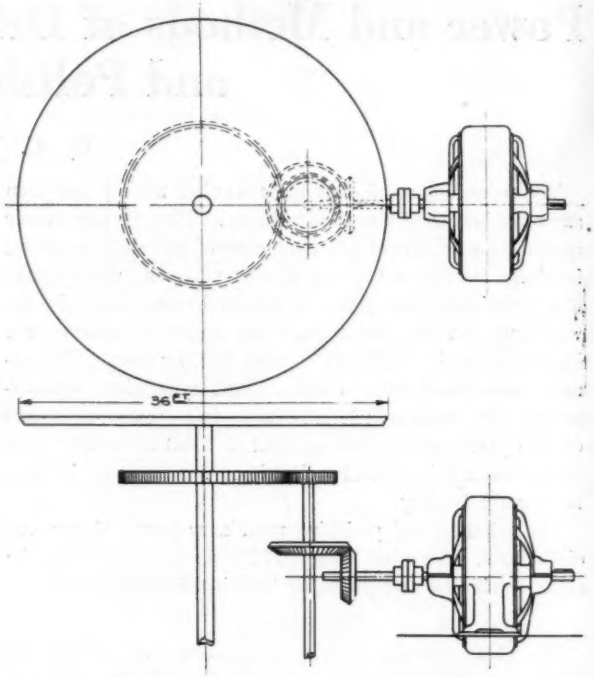


FIG. 3. DIRECT-COUPLED MOTOR DRIVE, WITH ONE BEVEL GEAR AND ONE SPARE GEAR REDUCTION

intermediate shaft driven through belt or ropes by the motor.

It is seen that both of these arrangements, while permitting the use of higher speed motors of slightly lower first cost, necessarily take up much more space than if the motor were mounted on the bevel pinion shaft. Since the driving equipment is generally located in a pit or basement it means, therefore, a higher cost for excavation and concrete work. By coupling the motor to the pinion shaft the losses in belt or rope transmission are also saved. This method of drive at first met some opposition, it being felt that the belt or rope gave an added necessary flexibility at starting. It was further thought that trouble would be experienced with the coupling under the frequent starting, for where the motor is used for spotting the table on the track after the grinding or polishing is finished, the motors must be jogged perhaps 200 times per day.

Installations of this arrangement have proven that this duty is not severe for some couplings of the flexible type, and further, due to reduced backlash of a coupling as compared

with a belt, the tables can be spotted on the track with fewer trials.

But the gears still remain in the circuit so to speak, and these gears are expensive; expensive in first cost and maintenance, and expensive on account of their power losses. The question is, can these gears be eliminated? This problem has been studied for several years with the conclusion that where no operation at reduced speed is required the table can be driven by a synchronous motor through one gear reduction with a very appreciable gain in first cost, overall efficiency, cost of installation and simplicity of control. If the motor is arranged with vertical shaft, the bevel gear and pinion can be omitted and these are the source of greatest trouble.

Figure 4 shows this arrangement and gives an idea of the relative size of motor and table for a 700 horsepower, 75 revolution motor driving a 36 foot table. No doubt the dimensions of such a motor are surprising to many. The outside diameter is only slightly over 12 feet, and the face of the rotor is not as much as the face of the bull gear, being less than 15 inches.

The cost is another surprising feature. The cost of this

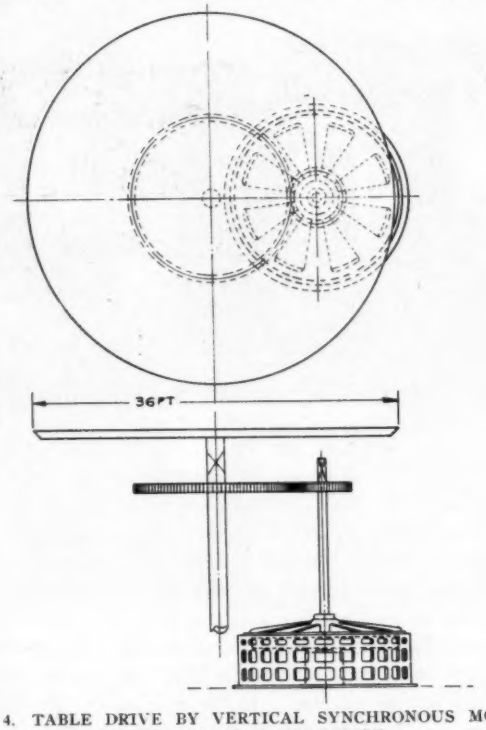


FIG. 4. TABLE DRIVE BY VERTICAL SYNCHRONOUS MOTOR, WITH ONE GEAR REDUCTION

type motor in this size is actually less than the cost of the induction motor alone shown in Fig. 3. And when, to the cost of this latter motor, is added the outboard bearing, bevel gear and pinion, vertical shaft and step bearing, the vertical synchronous machine is very much less expensive.

The efficiencies of the four types of motors, so far discussed are very close together, averaging 91 per cent. But by the elimination of the bevel gear and pinion, the overall efficiency of the vertical synchronous motor arrangement is at least 6 per cent better than any of the others. The larger plants operate eight polishers and eight grinders with an average annual power consumption of 30 million kilowatt-hours for these processes alone. A 6 per cent saving on 30 million kilowatt-hours amounts to $20,000 to $30,000 annually, depending on the cost of power.

All of the methods of drive discussed so far have been or are being built and installed, but there is still one step to be taken, and that is to mount the vertical motor directly on the main table shaft (Fig. 5). In the study of this drive the direct current motor, the induction motor, and the

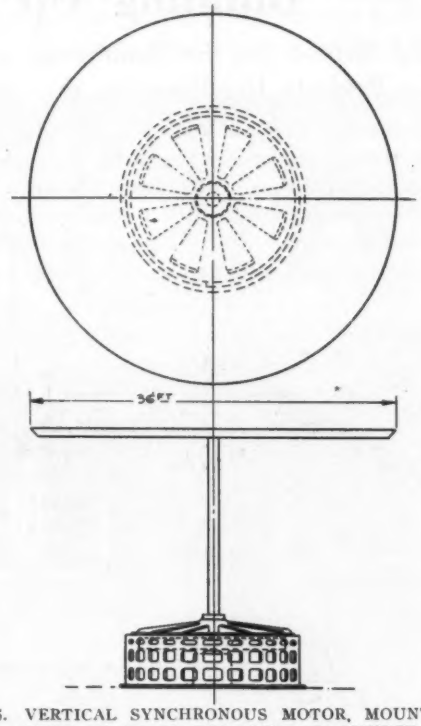


FIG. 5. VERTICAL SYNCHRONOUS MOTOR, MOUNTED ON MAIN SHAFT OF POLISHER OR GRINDER

synchronous motor were considered. The direct current machine with its large commutator proved too costly a layout. Even the alternating current machines at standard frequencies ran to large diameters and a large number of poles, for it must be remembered that we are talking now of 13 to 20 revolutions per minute, which at 60 cycles would require at least 360 poles, and for 25 cycles, 150 poles. The power factor of the induction type motors was much too low to be considered.

The most promising arrangement was the synchronous machines designed for 10 or 15 cycles, using a low frequency generator or frequency changer set for the power supply. This motor is not essentially different in overall dimensions from the motor of Fig. 4. All the gears, all the thrust bearings except the main motor bearing, and all the smaller shafts are eliminated. Mechanically the problems of applying this motor are no different from those of the motor with one gear reduction. Electrically the efficiency is high (86 to 88 per cent) the power factor is unity, and the reactance is high enough to permit the motor to be thrown on the line without the use of a compensator or transformer taps.

Control Equipment

For all of the motors considered above, push button control is the best, eliminating any of the personal element and

permitting the tables to come up to speed in the shortest desirable time. For the induction motors primary contactors are used, and if speed reduction is desired the slip ring motor is provided with reduced speed running points. A jogging contactor is used for spotting the table on the track. Performing this spotting or inching electrically saves a great amount of time. The jogging contactor is operated from a push button or master switch so located that the position of table with respect to track can be readily observed.

The motor control should be interlocked with the hydraulic device usually employed for lifting the table, so that the equipment cannot be started until the table is in position.

Building Up a Specialty Business

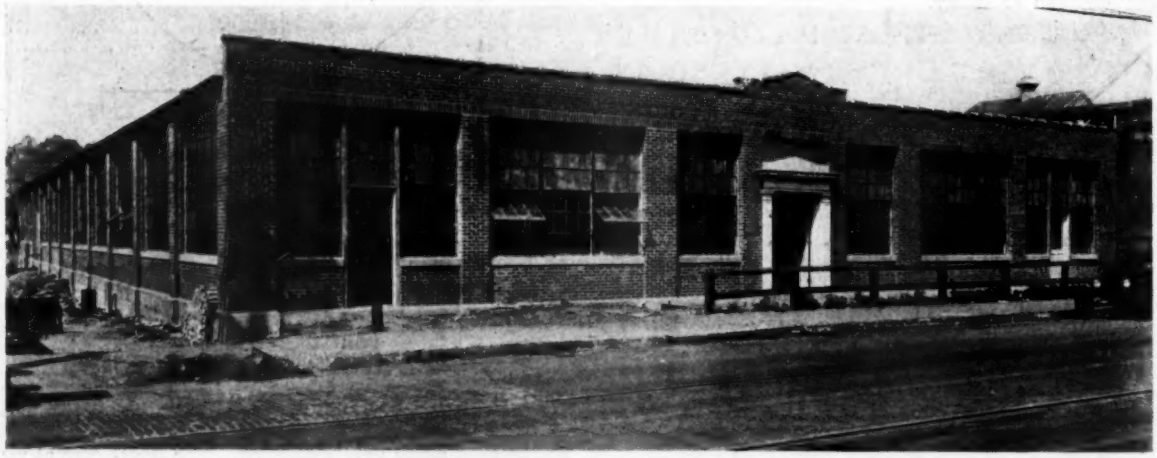
Successful Methods for the Manufacture of Plain and Beveled Glass Circles, Mirrors and Kindred Products Developed by the American Crystal Company, Waterbury, Conn.

Coincident with the notable progress made during the past few years throughout the basic industry engaged in the primary production of glass from raw materials and its manufacture into staple products (the total production of which, in the United States, rose from a value of $123,085,000 produced by the work of 74,502 men in 1914, to $213,471,000 produced by 54,748 men in 1921), there has been a parallel development of the secondary branches of the industry—those devoted to the fabrication of numberless kinds of specialties from "raw" sheet, plate and other forms of glass purchased from the primary producers.

INSTALLING THE EQUIPMENT

An interesting and typical example of the growth of an individual concern in this field is the American Crystal Company, of Waterbury, Conn., whose specialty is the manufacture of plain and beveled circles and mirrors for various industrial uses.

This business was started originally in 1919 at Kingston, N. Y., but largely because of unfavorable local labor conditions was not a success and was moved a year later to Waterbury, where manufacturing was resumed in a small way with but five men and fifteen machines. In its present location it now employs about 85 men and 126 grinding machines but by the time this article appears this entire equipment will have been moved and installed with additional equipment in a large modern building just erected by the Company for the purpose. In the new factory production capacity will be increased fifty per cent immediately and plans have been made for adding new lines, eventually quadrupling the Company's output and giving employment to several hundred workers.



NEW PLANT OF THE AMERICAN CRYSTAL COMPANY

The company was incorporated in 1922 with a paid-in capital of $100,000. Its organizer, John D. Baker is president and general manager and E. B. Reiley is secretary and treasurer.

The principal products of the Company are plain and beveled glass circles for dial gauges, speedometers, motor and other meters, flashlights, mirrors for vanity cases and lipsticks, automobile rear view mirrors, watch crystals, clock glasses and plain circles for all purposes. Beveled goods are

being made from 5/8 inch to 7 inches in diameter and plain circles from one inch to 10¼ inches diameter. The daily production of the old plant just being abandoned has been approximately 32,000 beveled circles, 45,000 plain circles, and 7,000 mirrors. This involves an average consumption of a carload of glass a week, equal to a long train load every year.

These products are made from strip glass in convenient and economical sizes for cutting. At present the bulk of the material used consists of flat drawn sheet of Libbey-Owens manufacture, the balance including a substantial proportion of American Window Glass, a small quantity of imported sheet, and some Standard Plate Glass Company products.

CUTTING AND CLIPPING THE CIRCLES

INSPECTING THE GLASS FOR FLAWS

GRINDING AND BEVELING THE EDGES

POLISHING THE BEVELED EDGES

The cutting, grinding, washing, polishing and other necessary operations appear simple yet they involve many little kinks and practices that have an important effect on production costs. In fact, in all factories of this kind the rate of production depends so directly upon the aptitude, skill, initiative and sincerity of the operatives that the ultimate success or failure of the venture depends largely upon securing their cooperation, labor on this class of product constituting an extremely high percentage of the total cost of manufacturing.

The factory operations at the American Crystal plant are here described in practically the same sequence that occurs in practice. The glass, in strips or sheets, is brought from the stock room to the cutting tables where it is divided by hand into squares slightly larger than the diameter of the finished circle that is wanted. The squares are sorted and gauged for thickness, apparatus made by B. C. Ames Company of Waltham, Mass., being used for this purpose. They are then taken to the circle-cutting machines, ten of which are in use. The essential part of the circling machine is a vertical shaft, from the lower end of which a cross-bar extends horizontally for a distance slightly longer than the radius of the largest circle that is wanted. A cutting diamond is attached to the cross-bar, adjustable to any desired diameter of circle. The diamond is brought into contact with the upper surface of the glass and a quick turn by the operator's hand of the small crank connected to the top of the shaft causes the diamond to rotate and inscribe a circle on the glass. The operator then grasps the square of glass in both hands and in order to open up the cut made by the diamond he applies pressure by back-and-forth twisting motions of his hands, not unlike those used by many persons to loosen up and separate a pack of new playing cards.

This opens up the cut sufficiently to enable the "clipper" on the opposite side of the work table, to whom the square is passed, to remove all the edge portions and surplus glass

outside the circle very easily by means of two or three pinches from a pair of ordinary clipping pliers. Sometimes when the thickness of the glass and size of circles permit it, two circles are cut on one block of glass, which of course reduces handling cost.

The cutting method just described is said by Mr. John White, who is in charge of operations, to have proved more satisfactory than machine cutting on glass having a thickness of .125 inches or more.

The diamonds used in the cutters will stand from six to eight resets. Sometimes one will last for eight or nine weeks while others become useless after a day or two. The record for endurance in this plant is 14 weeks.

After the circles are cut they are placed in wooden tray racks and taken to the inspection department to be examined for pits, seeds, scratches, chipped edges and other defects. The rejections average 50 per cent of the glasses examined. Formerly this was a total loss but nowadays a second inspection of rejected circles is made and many are found with their defects so situated that good circles of smaller diameter may be cut from them. A substantial percentage of the originally rejected pieces are thus partially reclaimed.

After inspection the circles are put into racks, tagged, and taken to the grinding or beveling department and set on brackets over the grinding machines, close to the operatives. The grinder has a vertical shaft, to the lower end of which there is attached a grinding wheel in a horizontal position At the left hand side there is a sliding work holder controlled by a lever. Extending through its center is a hollow tube, the outer end of which is connected with a vacuum pipe running from a Leiman vacuum pump. The circle of glass is placed against the inner end of the tube, a valve in the vacuum pipe is turned, exhausting the air from the tube, and atmospheric pressure holds the glass in place throughout the whole grinding process. Reversing the valve releases the glass and the operation is repeated continuously, as fast as the pieces can be handled by the operator. When the circle is first placed in position a slight movement of the lever by the operator draws the glass against the face of the grinding wheel. The whole operation is completed in a few seconds. The grinding operations for both straight edge and beveled circles are similar but the setting of the work holder is different. Different customers specify different bevel angles, ranging from 11 to 60 degrees.

After being ground, the glass circles are washed, placed in small lathes and polished with powdered pumice paste held against the ground surface of the glass by means of a wood polishing stick. Six polishers take care of the factory's present output.

Polishing having been completed, the glasses are dried in ovens, wiped by hand, again inspected for blemishes, then carefully wrapped in paper and packed in boxes, ready for shipment.

Silvered circles for mirrors are in demand for various purposes. These are usually cut in multiples from large sheets of glass which have previously been silvered in the mirror department. The first operation in this process is to wipe the glass perfectly clean, then obtain a chemically clean surface by washing it again in a solution of lead. The sheets are then placed on a level table which is heated to a certain temperature by burners underneath. A solution of silver is poured carefully and evenly over the glass which is allowed to dry slowly. The silver coating is then sprayed over with paint by an air brush. In some cases, where a mottled finish to resemble leather is wanted, lacquer is used.

Another process for which the plant is equipped is the bending of glass into concave form for watch crystals and similar uses. This is done by heating the glass circles to its softening temperature, then pressing it in a mold to the desired shape.

The new factory building of the Company is located on South Main street, Waterbury, Conn. It is 100 feet wide by 200 feet deep, of one-story steel and brick construction, modern in every respect, and unusually good provision for light has been made, the walls on all four sides consisting largely of window glass. Skylights in the roof provide ample light for the central portion of the building. A general system of electric lighting was adopted in preference to the unit system. The Hoffman vapor system of heating has been installed to take care of indoor temperatures under all conditions.

In accordance with modern practice, the "straight line" idea for the movement of materials has been followed in the layout of equipment. Raw materials, mostly glass, come in at the back of the building and pass through all necessary operations without retrograde movements, beginning with the unpacking of the glass and following through the departments of sorting, gauging, circle cutting, clipping, inspection, grinding or beveling, washing, polishing, drying, wiping, wrapping, packing and shipping. Mirror work of course follows a slightly different route, taking in the silvering department on its way.

The Company executives take a genuine interest in the welfare of their employees and in recreational and other activities. The factory basket ball team last season won second honors in the local city contests. A safety committee meets weekly to discuss accident prevention and health matters. Although large quantities of glass are constantly being handled, cuts and other accidents are kept at the minimum.

New Method of Making Frosted Glass

Decorative effects produced with frosted glass in electric lighting are pleasantly familiar. Frosted glass is also important in photography and numerous minor uses may easily be remembered. Several processes are available for the preparation of frosted glass. Sand blasting and other forms of grinding can be used. Then there are chemical methods by which the glass surface is etched with compounds containing fluorine. More recently, every pleasing effects have been secured by the aid of silicate of soda. In a silicate solution particles of clay or other mineral are suspended and applied to the glass surface. The coating is then set by an application of some chemical salt which reacts with the silicate of soda and makes it insoluble in water. Patents in the interest of the British Thompson Houston Company and the Eastman Kodak Company on making frosted glass with the aid of silicate of soda have been recently published.—Philadelphia Quartz Co., *Silicate P's & Q's.*

The Manufacture of Thermos Bottles*

By J. Einig and R. Vorbau

In science, in industry and in the household, it is an important problem to maintain solid, liquid or gaseous substances at a given temperature for a long time, and to protect them from changes in temperature of the surroundings. There are a large number of methods and procedures in existence for attaining this object. They agree with one another in this point, that the object to be insulated is surrounded by substances which have a low heat conductivity such as cork, infusorial earth or wool. For example, steam pipes are covered to diminish heat losses as much as possible, ice boxes are protected to keep foods cool, and so forth.

The idea of using a vacuum for heat insulation is due to the English scientist Dewar. In order to keep liquid air for experimental purposes, he made glass containers with double walls, the edges of which were fused together. The air in the intervening space was removed as much as possible and the opening of the tube through which the evacuation of air was accomplished was fused until it was closed. These containers which made possible the working with liquid air in large quantities, are named after their inventor, Dewar flasks, and are the precursors of thermos bottles. It is a good example of a purely scientific invention which later has been utilized in industry to produce a very widely used article. The vacuum bottle was put on the market about twenty years ago by the Thermos Company in Germany; for this reason vacuum bottles are frequently called thermos bottles.

The direct heat conductivity through an air-free space is extremely small. But heat transfer through radiation takes place. In order to prevent this heat transference, the inside glass surface in the space between both glass walls is made into a mirror, which reflects the heat rays like it does the light rays. Through the combination of the vacuum and the mirror the extreme heat insulating capacity has been attained.

The method of manufacture will be briefly described.

The vacuum bottle is composed of two principal parts, viz., the double walled glass vessel and the protecting cover with beakers, etc. The glass vessel consists, as is generally known, of two glass flasks which are fitted together and fused. The flasks are made almost exclusively in Thueringen and Lausitz glass works. They are hand blown with the use of moulds. The manufacture of the vacuum bottles is done in the following manner: The inner and outer flasks are cut off at the necessary length and after being cleaned, the inner flask is put into the outer flask and kept in place with three or four asbestos supports or with springs. The bottoms of the outside flasks are melted together and rounded; this is done by blowing. At the bottom a glass tube is melted onto the outside flask. This tube serves later to introduce the silver solution and for evacuation. Then the necks of the inside and outside flask are fused together. To this end the outside of the inner neck, after being softened by the glass blower's flame is turned over to the edge of the neck of the outside flask and the two are carefully fused together.

Now follows the chemical process of silvering the inside of the double-walled flask. Almost without exception the silvering of the glass flasks is done according to the old process. A solution of silver nitrate and a reducing agent are transferred to the hollow part and the flask kept in a shaking motion. In dilute solutions the reduction of the silver nitrate takes place slowly and the silver is deposited as a mirror on the walls. The object of the silvering has been mentioned already: the mirror reflects the heat rays. If a hot liquid is kept in the vacuum bottle the heat rays are thrown back into the interior of the flask, if the bottle contains a cold drink the entrance of heat rays from the surroundings into the flask is prevented by the outside mirror.

Vacuum bottles with a copper mirror have recently made their appearance in commerce. They are made by the German Auer Company. It is impossible to decide without further investigation whether the copper mirror surpasses the silver mirror. However, the flasks excel through a very high insulating power.

The silvering solution is removed from the bottle and the hollow wall of the flask is washed and dried. The glass tube is then drawn out to a capillary. The tubes of a large number of flasks are then fused unto the side tubes of a larger glass tube which is directly connected with a vacuum pump. The bottles are heated during the evacuation and when the desired vacuum has been obtained the capillary tube is fused together.

The glass part of the vacuum bottle is now ready. The bottles are tested by filling them with hot water and by determining the fall of temperature in 24 hours.

All glass working is done by skilled glass blowers. Many attempts to make vacuum bottles mechanically and with unskilled labor have been made, but without result. There exist a number of patents, many from the United States covering such machinery, none of which has proved to be useful.

In a similar manner Dewar flasks and food containers with wide necks are made. The requirements of a vacuum bottle are such that only the best glass can be used and their manufacture must be done with the greatest care. The glass must be pure, without stones and blisters, of equal wall thickness and it must be free from internal stresses. For this reason the flasks, after being made, are put in a lehr in which they cool slowly for 12 hours.

A practical apparatus has been worked out with which glass can be tested with polarized light to see if it is free from internal stress. Every condition of stress, even on a small space shows itself in polarized light through the appearance of colored spots. Certain conclusions as to the amount of stress can be made from the color of these spots.

The glass flask is then put into the cover which protects it against breakage. The cover consists of tin, aluminum, lacquered iron or brass. Galvanized iron is often covered with cloth, artificial leather or leather. A beaker is screwed on the neck of the flask or on the protective cover.

Between the glass vessel and the cover usually corrugated cardboard is inserted, to keep the flask firmly in the cover.

Keramische Rundschau, Vol. 32, No. 7. Translated for THE GLASS INDUSTRY.

On the bottom of the cover a disk of cork is placed, or a spring, to protect the glass and the fragile fused point of the tube. It is of great importance that the cover be well made, and that it fits closely against the glass flask, whose neck reaches outside the cover. Otherwise liquid, dropping from the flask may penetrate to the inside of the cover, wet the corrugated cardboard, and cause it to rot. Iron covers which get wet on the inside may even rust through. In high grade vacuum bottles the perfect fitting of the neck and the edge of the cover is insured by means of a rubber ring.

Vacuum bottles may be fitted out in many ways. Under the beaker, which is screwed onto the neck, a smaller beaker may be put, or a removable handle, which enables the user to hold a hot beaker. The vacuum bottle may be further provided with a ring which facilitates the pouring of the liquid and which prevents it from running down the outside of the neck. Especially strong are vacuum bottles with covers made of wood, which have been introduced into commerce recently.

It should be mentioned that efforts have been made to increase the mechanical strength of the flask by using flasks with exceptionally thick glass walls. These flasks can be used without a cover and only need a foot to protect the fused point of the side tube. Metal vacuum bottles are in many ways competitors of the glass ones, since double walled metal containers can be made stuffed with materials of low heat conductivity, such as charcoal, or infusorial earth. These substances are intended to replace the mirror. The much lower heat insulating power and the high price limits the use of these flasks to certain fields of application.

The applicability of thermos bottles is very extensive.

They are a practical article for every one who wishes to carry along hot food or drinks or who desires to keep drinks cool for a long time in a warmed climate. To give an idea of the heat insulating properties of thermos bottles it may be mentioned that a good vacuum bottle of about ½ liter content, when filled with water of 90 degrees Centigrade should deliver water of 45 degrees after 24 hours. For bottles with a copper mirror this temperature amounts to about 60 degrees. The power to keep liquids cool is on the same proportion. In a bottle filled with ice, it is possible to find pieces of ice after eight days.

Vacuum bottles will certainly find a much greater field of usefulness than is the case at the present time. The manufacture of thermos bottles is almost entirely confined to Germany. The factories of the United States, Japan, etc., play only a subordinate part in the furnishing of vacuum bottles to the world.

Activities of the Society of Glass Technology

Reports of Recent Meetings and Reviews of the Papers Read

The last meeting of the Society of Glass Technology for the session 1923-24 was held in Sheffield on June 18, the president, Col. S. C. Halse, C.M.G., in the chair. Two papers were presented.

SOME REMARKS ON THE ERECTION AND OPERATION OF MODERN POT FURNACES, by Percival Marson. In the absence of the author this paper was read by Prof. Turner.

The author pointed out that the glass manufacturer, before constructing a pot furnace, which represented so heavy a capital expenditure, should have adequate plans prepared. A furnace builder who knew his business should be able to guarantee his furnace, but in any case it was desirable to have a technologist as intermediary in order that suitable specifications might be laid down and adhered to. Among other things the builder should study the nature of the ground upon which the furnace was to be erected and he should construct an adequate foundation, providing also any necessary drainage and protection of the flues from ingress of water. The provision of suitable flue dampers with some form of indicator allowed of a more accurate regulation of the furnace during working. A small hole in the furnace above one of the pots served to give an indication, by observation of the issuing flame, of the state of combustion, so that correct conditions could thereby be attained. For a "full crystal" glass a furnace temperature of 1306° C. was sufficient and nothing was gained by exceeding this, but for soda-lime glass a temperature of 1400° C. could be maintained with advantage. It was claimed that for the crystal glass a circular pot was better than an oval or egg-shaped one, since it was less likely to cause cords in the glass.

NOTE ON AN UNUSUAL TYPE OF RECUPERATIVE TANK FURNACE, by F. W. Hodkin, B.Sc., and Prof. W. E. S. Turner, D.Sc. This paper was presented by Mr. Hodkin who gave an account of observations made upon a recuperative tank furnace in operation at the Belinda Works of Messrs. Lax & Shaw, Ltd., Leeds. The observations were made as the result of an invitation extended by Mr. J. S. Shaw to Prof. Turner to inspect the furnace.

The main feature of interest was the method of recuperation of the secondary air. This air entered by arched passages situated beneath the bottom of the tank and above similar passages conveying the exit gases to the chimney flue. It then passed by means of vertical channels in the working end of the furnace to a space between an upper and a lower crown. After traversing the space between the crowns the air entered the furnace through a series of ports which were placed so as to have the gas ports between them.

Producer gas was admitted, without preheating, through a gas-chamber connected with ports or burners opening into the melting end of the furnace. The flames traversed the whole length of the furnace, the products of combustion escaping through vertical downtakes in the working end to the flues beneath the tank.

The batch was charged through an opening at the side of the furnace and one big advantage claimed for the method of construction was that it permitted of working operations being conducted along the walls, not only of the working end, but also of the melting end, by the use in the latter of syphons.

The tank had a double bridge. In other words the bridge had three walls separated by cavities through which steam was blown for cooling purposes.

With gas at 700° C. and air at 720° C. the temperature of the glass in the melting end was 1,460° C. The production of glass from the tank, which was not being worked at full capacity, averaged 80 tons per week for a consumption of about 60 tons of coal on the producers. This glass was worked by three machines with feeders situated in the working end of the furnace, and by hands from four boots in the melting end. The designers anticipated a production of more than 120 tons of glass per week when working fully.

French Glass Manufacturers Visit England

During the last week of May a party of some 20 members of the Chambre Syndicale des Maitres de Verreries de France paid a visit to England at the invitation of the Society of Glass Technology, thus returning a visit paid last year to France by members of the British Society.

The program included visits to glass works, to Harrow School, to the British Empire Exhibition at Wembley and to the Department of Glass Technology of the University of Sheffield. On Tuesday evening the delegates were entertained at dinner in London on the occasion of the annual dinner of the society. The other guests were Dr. E. F. Armstrong, F. R. S. (president of the Society of Chemical Industry), Judge F. E. Bradley, LL.D. (Master of the Glaziers Company), J. Holland, Esq. (president

of the Ceramic Society) and Dr. C. Baring Horwood (Master of the Glass Sellers Company).

Prior to the meeting in Sheffield the French delegates were the guests of the Society of Glass Technology at luncheon, and in the evening a motor trip was made to Haddon Hall via Chatsworth Park

During the week two meetings were held. The first was held in University College, London, on Tuesday, May 27, and was a joint meeting with the British Society of Master Glass Painters. The president of the latter society, the Earl of Crawford and Balcarres, was in the chair and was supported by Col. S. C. Halse, C.M.G., president of the Society of Glass Technology. Three papers were presented.

Dr. Ethel Mellor, in a paper entitled THE DECAY OF WINDOW GLASS FROM THE POINT OF VIEW OF LICHENOUS GROWTHS, gave an interesting account of the acceleration of the decay of glass in ancient stained glass windows by the growth of lichens which made their habitat on the glass. Numerous specimens of these were exhibited and the paper was illustrated by a number of slides.

Mr. Noël Heaton, B.Sc., contributed a paper on THE DECAY OF MEDIAEVAL STAINED GLASS. He referred to the wide variations in resistance to decay found in mediæval stained glass. He considered that this was to be attributed mainly to variations in the composition and physical structure of the glass used.

Window glass was introduced by the Romans, who arrived at a very sound composition, and their glass was remarkably durable. Analyses of glass of different periods revealed the differences in composition which resulted from a departure from the Roman tradition in mediæval times. The resulting loss of durability was illustrated by a series of slides. The lowest ebb was reached about the end of the fourteenth century, one of the most notable examples being the glass of York Minster, which was in such an extreme state of decay as to require the most careful supervision in its repair.

In the process of decay two causes operated simultaneously; surface weathering due to atmospheric action, and well defined pitting due to the structure of the glass. The variations found in stained glass of the same period was attributed mainly to primitive methods of manufacture, with certain affecting causes. It was characteristic of mediæval glass that the painted portions resisted decay better than the glass iself, which might be attributed to the lead silicate used uniting with the glass to form a more durable composition. The reverse was the case in later times, the enamel often perishing while the glass remained sound.

The last paper was THE WEATHERING AND DECAY OF GLASS, by Prof. W. E. S. Turner, D.Sc. Ancient observers, attributed the decay of glass to various causes, some to the moon, others again to the sun. Even as recently as 1879, James Fowler in his well known treatise on this subject made a minute examination of the decay of glasses of different epochs without being able to come to any precise conclusion. But the nature of the corrosion of glass had been methodically studied by the physical chemist, and the principal causes were now fairly well known.

The chief agent of the action of the atmosphere was moisture. All glassware absorbed moisture to an extent dependent in the first place on its composition, but partly also on the manner in which it had been treated by the workman. Glasses with little stability were those which contained excessive proportions of alkaline oxides, whether of sodium or potassium. Glass of the type, silica-soda-lime (such as window glass and ordinary sheet glass) which contained more than 18 per cent. of sodium oxide too readily decayed; at the same time the presence of at least 2 per cent. of potassium oxide permitted the total alkaline oxides to be increased to 20 per cent. without serious danger.

The components which increased the resistance to decay of ordinary glasses were silica, lime, alumina and magnesia. Boric oxide was also very beneficial in a proportion of less than 12 per cent. The eventual hollowing out and the furrowing of glass in process of decay were associated with the mechanical treatment which it had received.

The second meeting was held in the Applied Science Department, Sheffield University, on Thursday, May 29. Col. S. C. Halse, C.M.G. in the chair. The following three papers were presented:

ALUMINO-SILICA MINERALS IN FIRED GLASS POTS, by W. J. Rees, B.Sc. Tech., F.I.C. N. L. Bowen and J. W. Greig, of the Geophysical Laboratory, Washington, U. S. A., had recently revised the investigations previously made on the binary system Al_2O_3:SiO_2. They showed that there was only one compound of alumina and silica which was stable at high temperatures. This compound had a composition 3 Al_2O_3, 2 SiO_2, and chemically was quite distinct from sillimanite (Al_2O_3. SiO_2), although its optical and crystallographic characteristics were almost the same. The crystals of so-called sillimanite which were found in the different kinds of fired refractory material and in the ceramic articles were always crystals of the compound 3 Al_2O_3. 2 SiO_2. Researches made by the author (Mr. Rees) during the firing of pots and blocks for glass works, as well as during their use at high temperature, corroborated the results obtained by Bowen and Greig. The proportion of 3 Al_2O_3. 2 SiO_2 which were found in refractory materials after firing depended upon the composition of the material, upon the degree and duration of the heating, and upon contact with, or absorption of, siliceous matter such as glass.

THE EFFECT OF VARIOUS CONSTITUENTS ON THE VISCOSITY OF GLASS, by S. English, M.Sc. To the glass manufacturer, the viscosity of molten glass is perhaps the most important of its properties, as it is the viscosity and the way in which it varies with alteration of temperature that determine whether a glass can be satisfactorily melted, plained and worked. Though the importance of this property has been realized, the practical difficulties of measuring the viscosity at temperatures up to 1,400 C. has prevented the subject being systematically investigated. Results have been published of only a few determinations, and the data provided do not always appear to be consistent, though it is not easy to test this point as the composition of the glasses are not generally given.

Of the various methods which have been used or suggested for the determination of the viscosity of liquids the "rotation" method seems to be the most useful for glass as it can be used over such a large range of viscosity. In applying this method, the glass was melted from cullet in a standard sized cylindrical crucible, and an iridioplatinum sheath secured on the end of a porcelain rod was rotated on its own axis in the centre of the crucible of glass. The time required for the iridioplatinum sheath to complete one rotation under different loads at various temperatures was determined, and the viscosity was given as a function of the product of the net effective pull and the time of rotation. The apparatus was calibrated by using syrup, the viscosity of which had been previously determined.

The glasses used consisted of a series soda-lime-silicates obtained by a molecular substitution of lime for sodium oxide in a simple sodium silicate, and a similar series in which the sodium oxide was substituted by magnesia.

The curves for the viscosities from about 750° to 1,400° C. show the way in which the viscosity is increased by substitution, and decreased by a rise of temperature.

THE THERMAL ENDURANCE OF GLASS. PART I, by V. H. Stott, M.Sc. In spite of its practical importance the theory of the thermal endurance of isotropic bodies had been somewhat neglected. A theory was submitted, which, however, owing to the complexity of the phenomena involved, was necessarily not entirely satisfactory. Actually it was possible to increase the thermal endurance of glass by a suitable thermal treatment, but a general method for effecting this could not be given. Another question of practical utility, which could not be determined in a general way, was that of finding the shapes of glassware which were most resistant to thermal shock in the limits imposed by usage. Here again, each case had to be specially considered. It seemed therefore that, from the point of view of thermal endurance, they could choose a glass which suited a given purpose according to its physical properties, but it was most difficult to determine the best process of manufacture for an actual article, or to arrive at a proper method of testing the value of the object made. It was therefore not desirable at present to fix any formal method of testing.

PART II. By V. H. Stott, M.Sc., and Edith Irvine, B.Sc. Experiments were made which showed that rupture was generally due to local differences of temperature, rather than to the uniform shrinkage of large surfaces. Although this interpretation of the experiments showed that the conditions assumed in the first part of the paper were not strictly fulfilled, the effects of the different factors were not greatly changed, and the formula cited would give satisfactory comparative results. In particular, since rupture was almost instantaneous, the conductivity of glass could not have great importance.

A party of members of the Society of Glass Technology visited Belgium during the week beginning July 7 and inspected several glass factories there.

The Glass Industry

The First Technical Trade Journal Devoted Primarily to Glass Technology, Engineering, Raw Materials, and Glass Factory Equipment and Operation.

Published Monthly by the
GLASS INDUSTRY PUBLISHING COMPANY, INC.
50 Church Street, NEW YORK

Telephones { Cortlandt 2465 / Cortlandt 5618 — Cable Address, Glasdustry

J. B. KRAK, Technical Editor

Subscription Price.....$2.00 a Year
Single Copy.....20 Cents

THE GLASS INDUSTRY circulates extensively among American and foreign glass manufacturers, their business executives and technical and factory operating staffs.

ADVERTISING RATES SENT ON REQUEST

Vol. 5 NEW YORK, AUGUST, 1924 No. 8

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Readers of THE GLASS INDUSTRY in the United States and elsewhere are requested to favor the Editor with any information available from time to time concerning developments in their own or other fields which would be of general interest to the industry. Authoritative facts about new glass manufacturing projects, re-organizations, new factory construction, new processes and equipment, raw materials, manufacturing and market conditions, personal items, and other appropriate subjects would be welcomed.

Those experienced in the practical, technical or executive activities of glass manufacturing who are qualified and willing to lend their aid to the upbuilding and progress of the industry by giving from their store of knowledge to others, are invited to submit for publication articles on any subjects relating to glass which would be of interest and value to our readers. The authors of accepted articles of this kind will be compensated at usual rates.

Summer Storage of Coal

In a communication recently issued by the Department of Commerce, Secretary Hoover reminded consumers of coal that during 1923 the railways, through the cooperation of the manufacturing and distributing trades and the coal operators and distributors, were able to handle the country's coal traffic in a most efficient manner without car shortages. This to a considerable degree was made possible by cooperation among the trades for the purchase and storage of coal during the summer season. The great danger point of traffic congestion is the fall season when the combined crop, winter goods, and household coal movements have always, except through last year's cooperation, combined to create a car shortage.

The fall car shortage always has the effect of increasing the price of coal and of seriously disturbing the whole economic machine. Security for the coming winter lies in repeating the storage performance of last year, by the manufacturers of the country taking reserves of coal during the remaining months of the warm season, thus foregoing the necessity of coal shipments during the peak period in competition with the household movement. With the exception of "strike" years, these summer months are universally the period of lowest bituminous coal prices.

We also have a national problem in the long view of securing cheaper coal by maintaining more regularity in the production of our coal mines through planning out its seasonal fluctuations. This can only be brought about if the consumers are willing to store coal during the low production season.

Glass factories are heavy consumers of coal. There is every transportation and financial reason for them to store coal during the next few months in preparation for the autumn need, especially if they can arrange to do so on the basis of price guaranteed against decline.

Technical Consultation Service

THE GLASS INDUSTRY invites its readers to refer to this department any problems with which they may be confronted pertaining to raw materials, glass technology, laboratory and factory practice. While making no pretensions to the possession of unbounded knowledge or infallibility THE GLASS INDUSTRY is ready to assist its readers to the best of its ability in solving their problems. Readers who can offer better suggestions than those printed are invited to submit them. Questions should be submitted in writing and will be answered by mail as promptly as possible. The sources of all inquiries will be held in strict confidence.

Question 58.—Estimation of SO_3 in glass. Heretofore we have not paid a great deal of attention to this analysis, but recently have found it necessary to get more accurate results. Can you please advise me what method you use, or prefer, for the determination of SO_3 in glass containing the usual calcia, magnesia, soda, silica and using arsenic, nitre, selenium and cobalt.

Answer.—For the estimation of SO_3 in glass the following method may be used:

Fuse a one gram sample in a platinum crucible with 5 grams of sodium carbonate and separate the silica by two evaporations with hydrochloric acid. Dilute the combined filtrates to 400 cc., add 10 cc. of a 10 per cent barium chloride solution and allow to stand 24 hours. Any SO_3 present is precipitated as barium sulphate and estimated in the usual manner. None of the other elements present interfere.

You can also estimate SO_3 after first determining silica, iron and alumina, calcium and magnesia in the usual manner. The filtrate from the magnesia should be acidified with hydrochloric acid and barium chloride added. Of course, the latter method is not quite as accurate as the first procedure. If great accuracy is required a two gram sample of glass

should be used and ten grams of sodium carbonate. It is necessary to run a blank on the reagents.—J. B. K.

Question 59.—Use of Charcoal in Glass Batch. In the July, 1924, issue of your journal we noted your article on "The River Rouge Plate Glass Plant of the Ford Motor Company" and were very much interested in the glass batch given on page 123. We would like to inquire for what reason the 1¼ pounds of charcoal is put into the batch and of what benefit it is to the glass?

Answer.—Charcoal is put into the batch to reduce the salt cake and to enable it to enter into reaction with the other batch ingredients to form glass. These reactions take place:

$$\underset{\text{(Salt cake)}}{2Na_2SO_4} + \underset{\text{(Carbon)}}{C} = \underset{\text{(Sodium sulphite)}}{Na_2SO_3} + \underset{\text{(Carbon dioxide)}}{CO_2}$$

The carbon dioxide being a gas goes up the chimney with the gases resulting from the combustion of the fuel. The sodium sulphite reacts with the sand as follows:

$$\underset{\text{(Sodium sulphite)}}{Na_2SO_3} + \underset{\text{(Sand)}}{SiO_2} = \underset{\text{(Sodium silicate)}}{Na_2SiO_3} + \underset{\text{(Sulphur dioxide)}}{SO_2}$$

The sulphur dioxide escapes as a gas, and the sodium silicate combines with the other components of the batch to form glass.

The molecular weight of carbon is 12, and that of salt cake 142.2, in other words, every 284.4 pounds of salt cake require 12 pounds of carbon. Hence, 24½ pounds of salt cake in the Ford Company's batch require 1.03 pounds of carbon. Since charcoal always contains a certain amount of ash the quantity has been raised to 1¼ pounds. In some glass factories a larger proportion is used.

The amount of charcoal used in the batch referred to is theoretically correct and has doubtless given satisfactory results in practice.—J. B. K.

Annual Gathering of Glass Manufacturers at Atlantic City

American Association of Flint and Lime Glass Manufacturers Hold Interesting Meeting. Wage Committees Make Progress

The annual convention of the American Association of Flint and Lime Glass Manufacturers which opened in Atlantic City on July 14 was attended by only a moderate number of glass manufacturers and their representatives, but it proved to be an interesting occasion.

At the meeting on Monday afternoon in the Marlborough-Blenheim Hotel an address by John Beiswanger, vice-president of Gill Brothers Company, Steubenville, O., on "The Tariff" was listened to with great interest.

Enthusiastic approval of the protective tariff policy of the Republican party and a firm opposition to ratification of the proposed anti-child labor amendment to the federal constitution marked the session.

The proposed child labor amendment to the constitution of the United States, now before the legislatures of the various states, provoked an extended discussion which culminated in a decision by the convention to formally petition the legislatures of states in which glass manufacturing is an industrial factor to reject the proposal. Calvin B. Roe, vice-president of the Fostoria Glass Company, initiated the discussion with a lengthy report on the genesis of the agitation to restrict child labor. Thomas McCreary, of the Phoenix Glass Company, Monaco, Pa., and others followed Mr. Roe in denouncing the movement as illogical and destined seriously to affect the industrial education of the nation's youth as well as to hamper the industrial processes of the country.

It was evident, however, throughout the discussion, that few of the speakers believed any organized effort to defeat the amendment could be successful and employers were advised that the wisest course would be to prepare to meet such conditions as ratification of the amendment might bring about in their respective plants.

A short address was made by C. M. Rodefer who compared the platform of the two dominant political parties in an interesting and effective way, and a number of others present, including E. J. Barry, president of the National Association of Manufacturers of Pressed and Blown Glassware, spoke briefly on various subjects.

W. A. B. Dalzell, of Moundsville, Ohio, was re-elected president of the association. Other officers re-elected for the year are: Marion G. Bryce, Pittsburgh, first vice-president; Nicholas Kopp, Pittsburgh, second vice-president; Emery P. Ebberts, Monaco, Pa., treasurer; John Kunzler, actuary. These officers were also elected directors, along with Arthur J. Bennett, Cambridge, Ohio.

A telegram was received from Marshall W. Gleason, president of Gleason-Tiebout Glass Company, Brooklyn, N. Y., expressing regret at his enforced absence from the annual meeting, the first he has missed in thirty years, during many of which he served the association as president. Great disappointment was felt over his absence.

Resolutions expressing regret over the deaths of several members and former members during the year were passed. The losses included A. J. Smith, president of the McKee Glass Company; William C. Brady, former president and director of the Hazel-Atlas Glass Company; Myron L. Case, president of the Crown Window Glass Company; Nathan B. Scott, until recently president of the Central Glass Works; and Thomas Evans, president of Macbeth-Evans Glass Company.

An important step was taken when the report of the committee on arbitration consisting of Victor G. Wicke, George Dougherty and John Beiswanger was adopted recommending that the president be given power to appoint a permanent committee of three, to which disputes between members regarding patent infringements and other matters might be referred with the object of avoiding litigation.

A motion was passed re-affirming present terms to customers. A proposal to lower the charges on all round packages was not accepted and present prices were re-affirmed by resolution. The prevailing opinion of those present was that nothing could be gained by making the proposed reduction. V. G. Wicke, of the Imperial Glass Company, expressed the opinion that no good would result from a concession of that nature and intimated that the only thing that would really accelerate buying was to take the "bull by the horns" and make a decided reduction in prices. No one explained how this could be done while wages remain at their present level.

The wage committee conferences, which followed the Flint Manufacturers' meeting, have resulted up to the time of going to press in agreements on wage scales and working conditions in the departments of hand pressed ware, machine press, paste mold, iron mold, chimney, punch tumbler and stemware. There was no change in the wage scale in any of these branches, and only minor changes were made in working conditions. The other departments were being taken up for consideration in regular order.

The only serious disagreement during the early course of the conference occurred in the punch tumbler and stemware department.

Here the controversy threatened to have the effect of causing a discontinuance of negotiations. The present wage scale agreement expires September 1. The manufacturers proposed that the workers accept a reduction of 20 per cent in the wage scale. Spokesmen for the workers refused to consider any wage cut whatever. Reaching an impasse, the manufacturers served notice that they did not consider there had been any settlement or agreement on the present wage scale. Taking exception to the refusal of the men to accept the wage reduction they reserved the right to cease operations at any time. A cessation of production of punch tumblers and stemware would throw approximately 800 workers out of employment throughout the industry.

At the meetings of the wage committees, E. J. Barry, of the Libbey Glass Manufacturing Company, and president of

the manufacturers' organization, was the chief spokesman for the manufacturers, while the workers were represented generally by William P. Clarke, president of the American Flint Glass Workers' Union.

Those Present

The following members attended the convention:

J. W. Collins, Bartlett-Collins Glass Co., Sapulpa, Okla.
R. C. Faris, Belmont Tumbler Co., Bellaire, O.
W. L. Orme, Cambridge Glass Co., Cambridge, O.
George Dougherty, Economy Glass Co., Morgantown, W. Va.
W. A. B. Dalzell and C. B. Roe, Fostoria Glass Co., Moundsville, W. Va.
John Beiswanger, Gill Brothers Co., Steubenville, O.

SOME OF THE GLASS MANUFACTURERS AND TRADE PRESS REPRESENTATIVES IN ATTENDANCE AT ATLANTIC CITY CONVENTION

Victor G. Wicke, Imperial Glass Co., Bellaire, O.
H. J. Batsch, Indian Glass Co., Dunkirk, Ind.
L. O. Griffith and William McCleary, Jefferson Glass Co., Follansbee, W. Va.
Thomas McCreary and E. P. Ebberts, Phoenix Glass Co., Pittsburgh, Pa.
E. P. Ebberts represented by proxy the Pittsburgh Lamp, Brass & Glass Co., Pittsburgh, Pa.
M. A. Smith, McKee Glass Co., Jeannette, Pa.
Howard Jenkins, D. C. Jenkins Glass Co., Kokomo, Ind.
C. M. Rodefer, Rodefer Glass Co., Bellaire, O.
John Kunzler, by proxy, Gleason-Tiebout Glass Co., Brooklyn, N. Y.
Reuben Haley, United States Glass Co., Pittsburgh, Pa.
Chas. H. West, Westmoreland Specialty Co., Grapeville, Pa.

The trade paper representatives included: Calvin F. Demarest and H. Montgomery, Jr., of the *Crockery and Glass Journal*; C. H. Handy, of *Pottery, Glass & Brass Salesman*; J. G. Kaufmann, of *The Glassworker*; T. A. Kimes, of the *National Glass Budget*. Other publications represented were *Ceramic Industry*, and THE GLASS INDUSTRY.

During the convention of the Glass Bottle Blowers' Association, in Atlantic City, the suggestion was made by President John A. Voll, that conventions be held every other year instead of annually. Those in attendance at the convention were favorable to the suggestion, but it was not actually put into effect pending a more extended consultation with the membership as to their attitude on the question.

Glass Sand Investigations

In the course of a general study of the technology of silica, being conducted by the Department of the Interior through the Bureau of Mines, observations have been made recently in the glass-sand and ganister districts of Mapleton and Mt. Union, Pa., and Berkeley Springs, W. Va. Methods of quarrying and mining were studied, including the use of explosives. Although the workings are all open cuts in the glass-sand quarries, loading of ore is done almost entirely by hand. In only a few instances are steam shovels used.

Washing or milling plants for glass-sand are very much standardized in the two districts, with the exception of methods of handling the wet, washed sand. These varied from hand feeding of bucket elevators to overhead traveling cranes with clam-shell bucket. The output of the two districts is almost the same, as far as quality is concerned, as they are mining the same bed of sandstone and using similar methods. One pulverizing plant at Berkeley Springs was visited where the washed sand is ground in tube mills. The product is used almost entirely in the ceramic industry. In all, nine plants were visited in the two districts.

John A. Voll Dies Suddenly

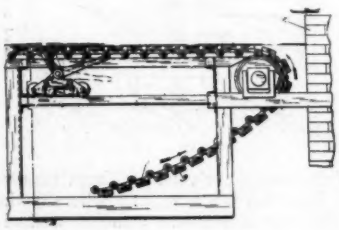
John A. Voll, president of the Glass Bottle Blowers' Association of the United States and Canada, died at Atlantic City on July 27, after an attack of acute indigestion. Mr. Voll, who was 55 years of age, was prominent in labor circles and had been an executive of the Glass Bottle Blowers' Association for twenty years. For nine years he was president of the Ohio Federation of Labor. At the annual convention of the bottle blowers early in July he was re-elected president for his eighth term. He was born in Zanesville, O., where he learned the bottle making trade and lived there until he was elected president of the union, when he changed his residence to Philadelphia where the national headquarters are located. He left a widow, a daughter and a son.

Recent Patents

NEW INVENTIONS DESIGNED TO IMPROVE GLASS AND THE MEANS OF PRODUCING IT

Copies of United States Patent Specifications may be obtained from the Commissioner of Patents, Washington, D. C. Price 10c each

Cracking-Off Device for Sheet Glass. U. S. 1,499,393. July 1, 1924. John H. Moller, of Charleston, W. Va., assignor to the Libbey-Owens Sheet Glass Company, of Toledo, O.

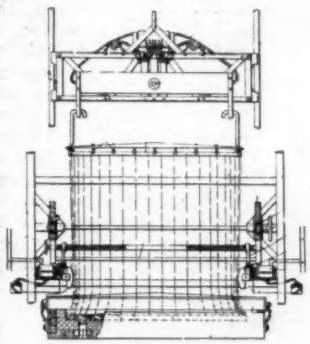


When sheet glass is produced continuously, and passed through a horizontal lehr or annealing oven, it emerges as a continuous strip upon some form of supporting table or conveyor, and is there divided into sections and carried to the cutting rooms. Usually the moving sheet, as it is carried along upon the table or conveyor is scored transversely with some form of hand-operated cutting tool, and the sheet is then slightly elevated, from beneath, adjacent the scored line, so that it will crack or fracture along the line.

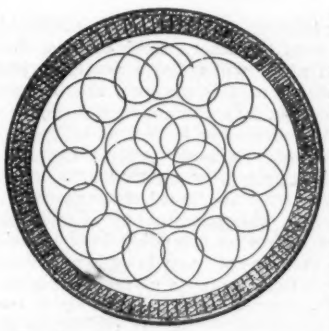
The object of the present invention is to provide a device, whereby the operator from his station at one side of the sheet, may elevate the sheet equally across its entire width at the scored line, thus securing a clean even break. The apparatus comprises means for simultaneously engaging the sheet from beneath at a plurality of spaced points across the width of the sheet, this means being mounted on a carriage movable to different positions beneath the sheet so that the apparatus can be readily placed beneath the movable score line.

Method of and Apparatus for Drawing Sheet Glass. U. S. 1,500,381. July 8, 1924. Robert L. Frink and Fred J. Frink, of Lancaster, Ohio.

The object of this invention is to adapt an electrically heated bait, such as one of the present inventors has heretofore perfected for use in drawing glass cylinders, to the drawing of glass in sheet form directly. Several constructional forms of bait for drawing glass cylinders are shown in United States Letters Patent No. 972,615, granted to R. L. Frink under date of October 11, 1910, including a support and a metallic band secured at separated points along one edge of said support whereby said band may contract and expand relatively to said support, means being provided for passing a heating electric current through such band so as to maintain the bait during the draw above the second point of tension in the glass, that is, above the point where the glass comes to a set. Among the inventor's claims is a method of drawing sheet glass, which consists in lowering into and raising from a bath of molten glass a rectilinear bait member having a co-efficient of expansion different from that of glass, and passing a heating electric current through said member, said current being regulated so as to maintain the temperature of said member at such a point that the glass in contact therewith is kept from setting and thus enabled to accommodate itself without rupture to any relative displacement of said member incident to a change in their temperature, said bait member being thus raised at a speed such as to produce a substantially uniform thickness in the sheet of glass, and thereupon severing such sheet from the bath, moving said bait with sheet thus attached in a horizontal direction from out of alignment with such bath, inclining said sheet at a slight angle against a suitable support, and cutting successive portions of desired length from the lower end of said sheet.

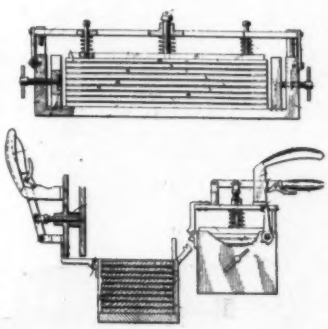


Gas Producer. U. S. 1,501,870. July 15, 1924. Charles A. Schranz, of Philadelphia, Pa., assignor to Walter Wood, trading as R. D. Wood and Company, of Philadelphia, Pa.



This invention relates especially to a type of gas producer in which two stirrer bars are used, one moving in a circular path within the path of the other. The figure illustrates the movement of the two stirrer bars in one revolution of the producer. It will be noted that the outer stirrer bar cuts the fuel bed in a path substantially similar to the path of the inner stirrer bar. The mechanism is so timed that in making one revolution, the stirrer bars terminate at a point some distance from the point at which the movement started. In the present instance, it is one-third the distance so that, when the producer shell makes three complete revolutions, the third convolution terminates at the same point as the first convolution started. This movement, thoroughly agitates the fuel bed and the extent of the agitation is substantially the same at and near the outer walls of the producer as at the center, owing to the fact that the outer stirrer bar is driven at a greater speed than the inner stirrer bar.

Glass-Plate Holder. U. S. 1,499,575. July 1, 1924. George Glaudel, of Los Angeles, Cal., assignor of forty-two and one-half per cent to George L. Mitchell, of Santa Monica, Cal., and fifteen per cent to Herman Miller of South Pasadena, Cal.



Some of the objects of this invention are to provide a glass-plate holder to facilitate the grinding of edges of plates of glass to remove their sharpness at the corners; to provide a holder which enables the rapid assembly or stacking of a number of superposed plates with edges to be ground set up in a common plane in slightly spaced position to permit the entry of a sand blast around corners of the stack of plates that are to be ground off by the sand blast. Another object is to provide means for yieldingly clamping the plates in stacked position, and which means is adapted to be quickly thrown into and from effective position for conservation of time and labor in use of the jig.

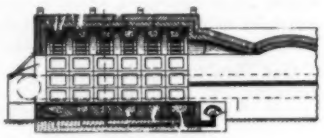
Process of Flattening Glass Sheets. U. S. 1,497,799. June 17, 1924. Harry G. Slingluff, of Mount Vernon, O., assignor to Pittsburgh Plate Glass Co.

This supplements the invention described in Patent No. 1,497,798 by providing for the flattening of "shawls" which will not satisfactorily and completely flatten in the process

described in that patent, by passing the partly flattened sheets between pressure rollers in the flattening oven.

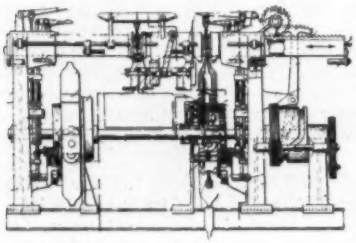
Annealing Lehr. U. S. 1,500,609. July 8, 1924. Henry L. Dixon, of Dormont, Pa., assignor to H. L. Dixon Company, of Carnegie, Pa.

The object of this invention is to provide means of practical and efficient character whereby a lehr may be heated electrically in a manner to insure the maintenance of the desired temperatures throughout the different portions of the lehr.



The heating chamber is provided with a series of internal flues which extend entirely around the heating chamber and are preferably spaced longitudinally one from the other. Each of these flues is filled with some material which will act as a resistance conductor for electric currents. For this purpose, the inventor employs a graphite in more or less comminuted form, or a mixture of carbon and silica commonly known as kryptol, or any other suitable material of this same general character. Each flue is provided with terminals or electrodes by means of which an electric current may be passed through the resistance material therein. In the construction shown, the electrodes or terminals are shown as extending into opposite lower corners of the flues, the current being intended to divide and take two paths through the resistance material from one electrode to the other. The current flow between these two paths may be properly proportioned, either by regulating the character of the resistance mixture or its density.

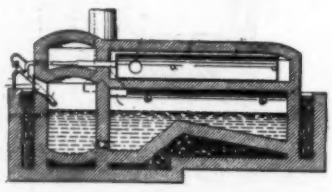
Glass-Molding Machine. U. S. 1,499,334. July 1, 1924. William G. Bergman, of Toledo, O.



Among the inventor's claims is a glass molding machine having in combination a constantly driven rotary shaft, a pair of mold carriers freely mounted thereon; two part molds slidably mounted on each of the four sides of each carrier, means for intermittently actuating each carrier, means for locking said carrier during intermission, means for moving each part of said molds to or from a common center synchronously with the movement of its carrier, means for feeding molten glass into the respective molds on the different carriers alternately and means for blowing the glass in said molds.

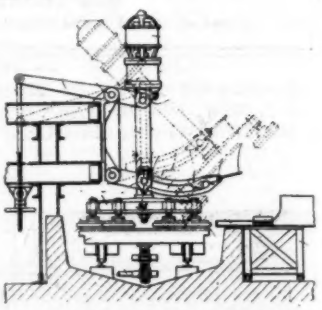
Glass-Making Apparatus. U. S. 1,500,651. July 8, 1924. William R. Smith, of Buffalo, N. Y.

A glass-making apparatus comprising a closed tank, a plurality of elongated tubular melting twyers extending through the wall of the tank, the inner ends of the twyers constituting burners located within the tank above the bottom of the latter, means for admitting gas and air under pressure to the outer end portions of the twyers, and means for delivering glass materials to the flame resulting from combustion at said burners so that said materials may be projected into the tank, melted by the burner flame and accumulated in a molten condition in the tank below said burners, the twyers being inclined and relatively arranged to cause the jets of flame, and the materials melted thereby, to impinge at a common meeting point on the surface of an accumulation of molten glass in the tank.



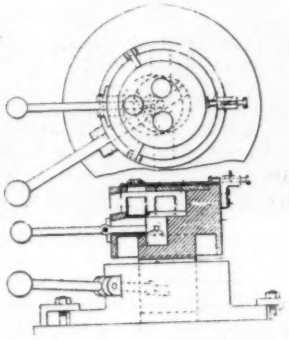
Apparatus for Surfacing Plate Glass. U. S. 1,501,327. July 15, 1924. John H. Fox, of Pittsburgh, Pa., assignor to Pittsburgh Plate Glass Company, a corporation of Pennsylvania.

The invention relates particularly to apparatus for polishing the glass in which the glass to be polished is carried beneath a series of polishers on cars or other carrier apparatus. After a certain period of use, the felts of the runners or blacks become caked with the rouge or other polishing material and their efficiency is reduced. The principal object of the invention is to provide a simple, convenient arrangement whereby the felts may be cleaned without removing the blocks or runners from the machine, and whereby the runners are made accessible for convenient removal and replacement or repair. Located on a roadway or track paralleling the track used by the tables is a truck carrying a pan. This pan is provided with a suitable cleaning liquid which is used in connection with brushes for successively cleaning the felts carried by the runner block when the surfacing unit is swung to the position illustrated in dotted lines.



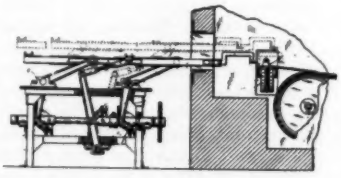
Glass-Boring Device. U. S. 1,497,887. June 17, 1924. Neil T. Albright, of Kokomo, Ind.

This invention relates to a drill block for use on a drill press wherein it is desired to drill a single or plurality of holes simultaneously through a piece of glass. For the prevention of chipping, it is necessary to drill the glass on one side and then reverse the same, drilling it on the other side in the identical spot through which the hole was started. In reversing the glass for this operation, it has been quite difficult to properly align the same so that the opposite drilling will coincide, particularly where there are a plurality of holes. This invention provides a block having mechanisms thereon for aligning the glass, whereby the drilling may be started on one side of the glass and then the glass may be reversed and properly positioned and set and held in such position so that the drilling of the opposite sides will coincide to a very fine exactness.



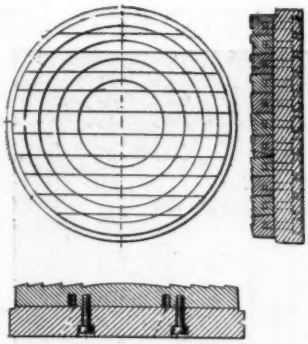
Lehr Feeder. U. S. 1,501,602. July 15, 1924. Minto K. Holmes, of Munice, Ind., assignor to Hemingray Glass Company, of Munice, Ind.

One of the inventor's claims is the combination, with a lehr provided with a ware receiving and supporting means, of a feeding conveyor leading laterally to said lehr and its article-receiving member, a pusher bar arranged alongside said feeding conveyor, means for reciprocating said pusher bar laterally relative to said feeding conveyor, the said pusher bar having its initial end spaced, longitudinally of the feeding conveyor, a distance slightly in excess of the diameter of the articles to be handled from the nearest obstruction to



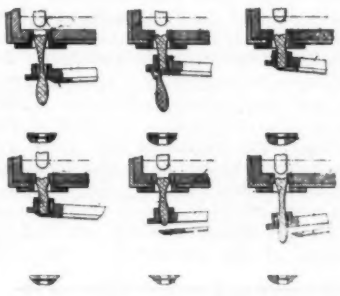
transverse displacement of the articles relative to the feeding conveyor.

Process of Making Glass-Mold Plungers. U. S. 1,501,246. July 15, 1924. Jacob Soderberg, of Pittsburgh, Pa., assignor to Pittsburgh Plate Glass Company.



This is a process for making plungers for glass molds for producing lenses having superimposed annular and transverse prisms, which consists in machining upon a base plate a series of transverse surfaces having the angles of inclination of the transverse prisms to be produced, fitting against such surfaces a set of metal strips substantially rectangular in cross-section, machining the outer faces of the set of strips to form a plane surface, machining into said plane surface a series of annular surfaces having the angles of inclination of the annular prisms to be produced, and then removing the strips and securing them with their rear faces against a supporting base plate.

Glass-Feeding Mechanism. U. S. 1,500,879. July 8, 1924. Edward Miller, of Columbus, O., assignor to Chapman J. Root, of Terre Haute, Ind.



In this mechanism there is a knife cooperating with the shear bar which has an opening through it for the glass to descend, and when the knife shears the glass, it closes the bottom of said opening and thereby forms a cup, and means to hold the knife temporarily in that position until the desired function has been accomplished before the knife begins to return to its inoperative position. To return the knife, it is first moved downward away from the glass retained in the cup of the shear bar. Also during the operation of temporarily holding the glass, the cutting mechanism is moved up closer to the discharge opening in the spout in order to receive the remaining glass and cause it to fill the cup, and as soon as this is accomplished and the knife begins to lower away from the shear bar through the shear bar opening by gravity to form the next gather, the shear bar is gradually moved downward, not only to normal position, but lower.

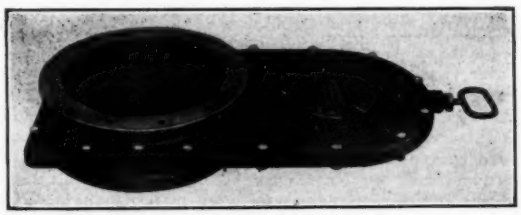
Glass Factory Equipment and Supplies

THE GLASS INDUSTRY will be glad to publish descriptions of new and useful devices, machinery and supplies of interest to the glass manufacturing trade. Most of the information printed in this department comes direct from the manufacturers of the products described.

Rockwell Air-Tight Blast Gate

To overcome the objectionable features of the ordinary blast gate which, while cheap in first cost, is uneconomical and inefficient in operation, a line of blast gates of superior construction designed and manufactured by the W. S. Rockwell Company, engineers and builders of industrial furnaces, 50 Church Street, New York, has come into quite extended use in various industries.

With the installation of modern devices for controlling furnace temperatures, the control of air, as well as fuel, has become essential, and it was to meet the demand for blast gates



ROCKWELL BLAST GATE, WITH FLANGED CONNECTIONS

that could be depended upon against leakage of air, accidental movements of the slide, and other faults of gates of flimsy construction that the Rockwell air-tight blast gate was put on the market.

An iron casing made in two parts and bolted together; a non-rusting, hard-rolled brass slide completely housed in; a handle passing through a stuffing box—these are the simple parts forming the Rockwell blast gate.

The slide moves in a machined runway, with just enough clearance to permit movement. The face of each half of the casing is also machined and this forms an air-tight joint. The handle attached to the slide extends outside the casing through a stuffing box. The casing is held together with finished machine bolts and may be readily taken apart.

It is claimed by the manufacturers that as all of the air may be passed through the blast gate and there is no leakage, the amount delivered is definitely fixed and positively controlled. This is true regardless of the type of automatic temperature control device employed.

ROCKWELL BLAST GATES, THREADED CONNECTIONS

The gates are furnished with standard pipe threads or with flanged connections as desired. The threaded style is made in 8 sizes for standard pipe connections of from 2 to 10 inches. The flanged style is made in 8 sizes of 4 to 16 inches.

The Hermansen Recuperative Furnace

The use of furnaces of the recuperative type has advanced much faster in Europe than here. Glass factories, along with many other industries, have utilized them extensively. Over 10,000 installations of one type alone, the Hermansen, are said to be in operation in various industries on the continent. In England numerous installations of recuperative glass melting furnaces have been made with such success, that over a year ago, during a discussion of this subject at a meeting of the Society of Glass Technology, the statement was made by Prof. W. E. S. Turner, the eminent authority on glass making, that he thought there was a great deal to justify the view that recuperative furnaces had come to that country to stay, and that to his knowledge, all pot furnaces being installed in England at that time were of the recuperative type. In

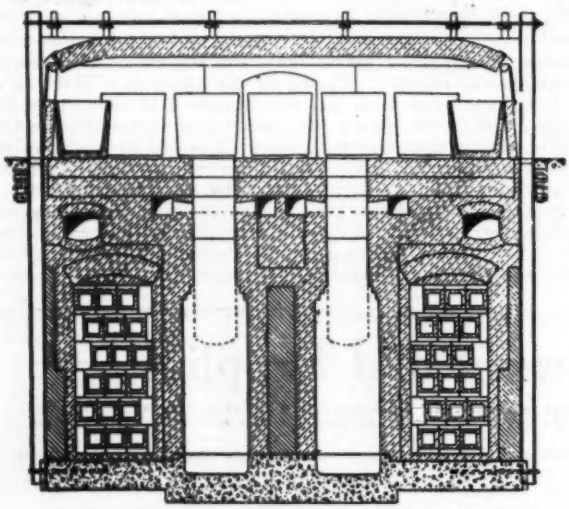


FIG. 1. A TWELVE POT HERMANSEN RECUPERATIVE FURNACE, LONGITUDINAL SECTION

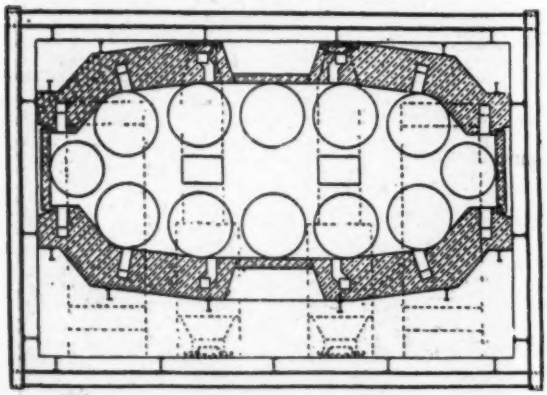
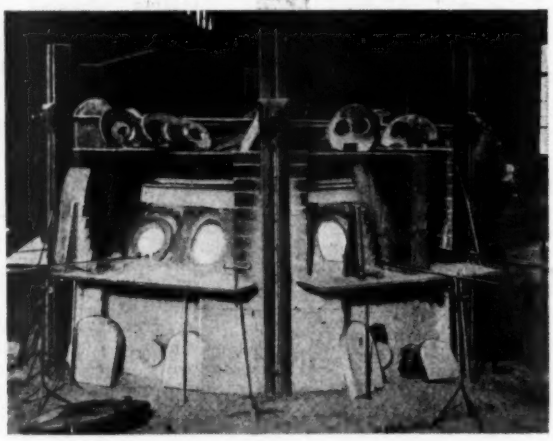


FIG. 2. HORIZONTAL SECTION

America comparatively few have been built, but in view of the increasing interest in, and constant discussion of recuperation and recuperative furnaces, and of certain advantages they admittedly possess, such as low installation cost and fuel consumption, it seems probable that they will soon come into more general use in glass factories.

The Hermansen furnace first came into prominence in the glass industry in Europe, in 1920. It was designed to produce the same or better results than the more cumbersome and expensive regenerative furnaces that had been used in the past.

The principle of the Hermansen Recuperator is very simple. It is claimed that they may be built most easily, economically and safely by using Hermansen standard fire brick blocks. These consist of square, hollow tiles, on the top and bottom faces of which there are notches forming cross channels when the tiles are placed on each other. At the ends, the tiles are formed so as to give good sealing even at relatively high pressure. The gases are brought in from above and down, while the air is led through the cross channels, alternating its direction for every other layer of tile, and always going upwards. Thus the flow is cross-flow with a more or less pronounced counterflow effect. The ends of the recuperator are equipped with access doors for cleaning the gas flues. Leak-



A SIX POT HERMANSEN FURNACE

age in the recuperator is prevented by the use of male and female flanges.

Figures 1 and 2 show a 12 pot glass melting furnace containing two sets of recuperators between which are step grate gas producers. From the gas producer, flues lead the producer gas through the combustion chamber, at which point hot air from the recuperators is introduced, which passes on to the working chamber and thence back to the recuperators. The furnace is said to be so constructed as to give complete circulation of hot gases around each pot.

The patent rights to the Hermansen furnace for the United States were recently acquired by the Combustion Engineering Corporation, Combustion Engineering Building, 45 Broad street, New York, whose substantial accomplishments in the fuel and furnace engineering field are well known.

New Method of Making Light Blown Ware

The Automatic Glass Products Company, Toledo, O., the incorporation of which was recently announced, has acquired the plant at Wellsburg, W. Va., formerly known as the Erskine Glass & Manufacturing Company, for the purpose of starting the manufacture by a new method of tumblers, stemware, electric bulbs, thermos bottles and similar products. The feature of the new method is the use of a new and improved composition mold. The company states that in actual tests conducted by Dr. Henry W. Hess, of Toledo, chemical engineer for the company, the ware made in these molds on equal tests with ware made from the same batch of glass under similar conditions showed a strength 58 per cent greater. According to Leonard J. Ulrich, president of the company, this type of mold is now being successfully employed in intensive production. It is asserted that the molds, when employed on products like those mentioned, give continuous operation and eliminate all difficulties encountered in pasted iron mold production. The ware produced in the composition molds is said to be well annealed when it leaves the mold. Those interested state that element of metal chill is eliminated and strains in the products not localized, therefore the finished article is stronger. Mr. Ulrich states that electric lamp bulbs and tumblers have been made for some time from tank lime glass which are extremely hard to distinguish from lead ware except by a practical glass man, and that the bulbs are being worked up into production by the lamp houses without shrinkage.

The Glass World and What It Is Doing

News of the Industry

Ceramic Trip Abandoned, Date for Meeting Changed

Announcement was made on July 8 by R. D. Landrum, president of the American Ceramic Society, after consultation with F. B. Ortman, general chairman of the Summer Meeting Committee, that it had been decided to postpone the Western trip indefinitely. Because of business conditions and the competition of unusually low steamship rates to Europe, it was impossible to secure a representation of Eastern ceramists that would measure up to the very fine entertainment which the Western members had planned for the Pacific Coast trip.

Since then it has been announced by Ross C. Purdy, general secretary, that the 1924 Summer Meeting will be held October 6 and 7, at the Hotel Biltmore, Los Angeles. Morning and afternoon sessions will be devoted to the reading of papers and discussions. Visits to local plants will be made. The dinner meeting will be held Tuesday evening, October 7. Railroad excursion rates will be granted with the usual stop-over privileges.

Fourcault Factories Report Progress

Evidence indicating that the Fourcault process of drawing sheet glass is becoming more and more firmly established on a commercial basis in the United States is contained in reports from several of the new plants that are in operation. Frank Bastin of the Blackford Window Glass Company, Vincennes, Ind., who fortunately seems to have escaped most of the difficulties usually met with in putting new processes into operation, reports continuous gains from day to day both in production and quality. The plant of the Quertinmont Glass Company, Fairchance, Pa., is also reported to be doing well. At the Continental Flat Glass Company, Shreveport, La., decided progress in both production and quality has been made. The new plant of the Clarksburg Glass Company, Clarksburg, W. Va., which is nearing completion will, it is expected, be put in operation during the latter part of August. Market demands for Fourcault glass have continued to be steady.

American Bottlers of Carbonated Beverages

The annual convention of the American Bottlers of Carbonated Beverages will be held next November 10 to 14, inclusive, in the Jefferson Armory, Louisville, Ky.

A number of glass manufacturers have already reserved space and others are negotiating for booths. The glass concerns which have already reserved space include: American Bottle Company, Toledo, O.; Charles Boldt Glass Company, Cincinnati, O.; Chattanooga Bottle & Glass Manufacturing Company, Chattanooga, Tenn.; George F. Collins & Company, Sapulpa, Okla.; Graham Glass Company, Evansville, Ind.; Illinois Glass Company, Alton, Ill.; Laurens Glass Works, Laurens, S. C.; F. E. Reed Glass Works, Rochester, N. Y., and the Root Glass Company, Terre Haute, Ind.

Requests for exhibition space should be addressed to James Vernor, Jr., 231 Woodward avenue, Detroit, Mich.

Glass Stocks Analyzed

An analytical study of the investment values of stock of the Pittsburgh Plate Glass Company, and of the American Window Glass Machine and American Window Glass Company has been issued by James Carothers & Company, Pittsburgh, Pa. In each case figures are presented covering the 10-year period from 1913 to 1923, inclusive. One of the many interesting items in the compilation states that the Pittsburgh Plate Glass Company "earned an average of 23.60 per cent per annum for the past 10 years, out of which it paid 9.71 per cent per annum on the capital." The American Window Glass Machine Company, combined with the parent company, the American Window Glass Company, earned an average of 27.19 per cent per annum on the common stock for the last 10 years, out of which was paid 5.43 per cent per annum on the common stock and 6.20 per cent in back dividends on the preferred stock.

Old New England Plant Closes

Due to changed conditions in the glass industry and after having operated for several years at a loss, the **Union Glass Company,** Somerville, Mass., a seventy-five year old concern and one of the last of the important New England manufacturers of blanks for cut glass, recently decided to close and sell its plant and discontinue business. Modern labor union conditions and growing foreign trade competition are given as the causes which led up to this decision.

Verified News of Trade Activities

The General Glass Corporation, Geneva, N. Y., which has taken over the plant of the Geneva Glass Products Company, recently commenced operation.

Turner Brothers Company, Terre Haute, Ind., have started operations at the plant at Winchester, Ind., of which they obtained control some time ago, but which has been idle for a long period.

The Pierce Glass Company, Port Allegany, Pa., is installing a new wind system in their present plant and a new factory building is being erected. The company is considering installing a batch mixing plant.

F. E. Reed Glass Company, Rochester, N. Y., are repairing their amber tank and letting out their green tank for repairs. They are at present operating their flint tank as usual.

Reports from Cincinnati state that the **Charles Boldt Glass Company** is putting in a large gas producer plant, the contract for the work having been given to the Toledo Engineering Company, Toledo, O.

The window glass department of the **National Sash & Door Company,** Independence, Kans., closed down late in June and it is reported will remain closed for several months, during which time repairs will be made.

Press reports state that the plant of the **Elk Run Window Glass Company,** Punxsutawney, Pa., which has been shut down for some time, has secured sufficient capital from stockholders to enable it to resume operations.

Jardine-Ferguson, Inc., Geneva, N. Y., has been incorporated with a capital stock of $10,000 to deal in glass, paint, etc. The directors of the new company are: Robert G. Jardine, Frederick L. Jardine and John W. Ferguson.

The Yunck Glass Manufacturing Corporation, manufacturers of tubing and electric bulbs, Orange, N. J., has been incorporated. The Corporation Trust Company, 15 Exchange place, Jersey City, N. J., are their representatives.

Belinky & Merino, Brooklyn, N. Y., has been incorporated with a capital of $20,000 to manufacture mirrors and glassware, by M. Belinky, L. Marino, A. Florentino. A. J. Todaro, 2411 Myrtle Ave., Brooklyn, N. Y., is attorney for the new company.

The first pot of glass was turned out of the new 1,000-ton tank at the plant of the **Pittsburgh Sheet Glass Company,** Washington, Pa., early in July. The old plant, which was

purchased and remodeled last winter, is now equipped with modern facilities.

Newspaper reports to the effect that the **Hart Glass Manufacturing Company,** Dunkirk, Ind., are installing two new continuous tanks are incorrect. They are building a new warehouse and have considered building one more continuous tank larger than their largest tank, and accompanying this work they will probably install a new batch mixing system and new power house.

The National Air Oil & Burner Company, 9th & Thompson streets, Philadelphia, Pa., has arranged to increase its capital stock from $75,000 to $1,000,000. The officers of the company are John F. Straitz, president; R. B. Dutt, vice-president; David W. Crossett, secretary, and Edward P. Bailey, treasurer.

The Indiana Glass Company, Dunkirk, Ind., resumed operations with one tank on July 14, after having been shut down for two weeks. The wooden covering over the west lehrs was dismantled and the Austin Company, Cleveland, O., has erected a new steel structure over both lehr and furnace rooms.

The Sunset Glass Company, 4001 Goodwin avenue, Los Angeles, Cal., recently organized, are building a day tank for the manufacture of automobile and signal lenses and kindred products. Production will be extended later to include tableware and other lines. W. S. Williams is chemist and general manager in charge.

The Mississippi Glass Company, 4070 N. Maine street, St. Louis, Mo., has awarded a contract to Dwight P. Robinson & Company, New York, for the erection of 1-story building, 40 x 112 ft. It is estimated that the building, which will be used as a gas plant and craneway, will cost about $60,000.

Glass making operations began about the middle of July at the plant of the **Ohio Glass Products Company,** Massillon, O. This marks the revival of glassmaking in Massillon. A large part of the capital obtained for remodeling the plant, which was formerly occupied by the Rhodes Glass & Bottle Company, came from local citizens.

The American Smelting and Refining Company, New York, announce that hereafter their entire production of arsenic, which was formerly sold through Edward Hill's Son & Company, New York, will be handled by their own organization. This change has been made on account of the automatic dissolution of Edward Hill's Son & Company upon the recent death of Mr. Edward Hill of that firm.

At the annual meeting of the **Brilliant Glass Company,** Brilliant, O., held at the New York office of the company, the finance committee was empowered to spend $25,000 in improvements under the direction of William M. Mathews, general manager. With the added equipment production capacity will be increased about 100 per cent.

The Armstrong Cork & Insulation Company announce the removal of their Rochester, N. Y., branch to new and enlarged offices, with greatly increased warehouse facilities, at 205-209 West Main street, Rochester, N. Y. This change became effective July 1, 1924. Their Omaha, Neb., branch has also been moved to new offices at 532 Peters Building.

Negotiations for the merger of the **American Thermos Bottle Company,** New York, which operates plants at Norwich, Conn.; Huntington, W. Va.; Toronto, Ont.; London, England, and Kokura, Japan, and the **Icy-Hot Bottle Company,** Cincinnati, O., are reported to be under way. The combined assets of the two companies are estimated to be about $4,000,000.

A merger of the **Cincinnati Plate Glass Company** with the **Standard Plate Glass Corporation** of Pittsburgh, involving a $250,000 financial transaction, was announced recently by Edgar Hill, secretary and treasurer of the Cincinnati firm. By the merger Mrs. Kate F. Terhune, who has been at the head of the Cincinnati concern since the death of her husband, Charles P. Terhune, in August, 1921, relinquishes her control of the company.

During a recent call at THE GLASS INDUSTRY office, Irving E. Adams the well known glass consultant mentioned that while visiting the factory of **Ball Brothers Company,** Muncie, Ind., recently he found that contrary to the general dull conditions prevailing throughout the trade they seemed to be very busy. They are operating four of their large fruit jar tanks, their flint tank and their white liner tank. Mr. E. B. Ball seemed quite optimistic regarding business conditions.

Messrs. Rothe and Schild, representatives of the Stinnes interests of Essen, Germany, visited the Hazel-Atlas Glass Company, Washington, Pa., and the Atlantic Bottle Company, Tarentum, Pa., early in July under the escort of Wm. J. Miller, of Swissvale, Pa., and inspected Miller feeders and other glass working machines in operation. Mr. Miller reports making a large number of domestic and foreign shipments of machinery recently, and states that while there is a slight summer depression at present, it is not alarming, as similar conditions have been experienced during other summer seasons.

It is reported that the **Brookville Glass & Tile Company,** Brookville, Pa., is in the hands of a receiver and that a trustee's sale of the property and rights is set for August 18. The company's difficulties are attributed to the tremendous pressure of old obligations, the handicap imposed by the fine levied on the company for infringement of American Window Glass Co. patents, expenses of litigation, Federal excess profits taxes, and expenses incident to changing from the old process to the new, the excessive breakage incident to the change and to training new crews, labor difficulties in several departments and other troubles which made it necessary to shut down the plant last April before the run was completed.

The Beaver Glass Manufacturing Company, Los Angeles, Cal., of which Elmer Beavers, vice-president and treasurer of the Beavers Seal Jar Cap Company, of Norristown, Pa., is president, announces that their plant will be improved to increase production capacity fourfold. The concern will manufacture a newly invented triple-seal Mason jar. The principle of the new top is embodied in a paraffin fiber disc, which takes the place of the usual rubber ring. The heat of the contents is said to effectively seal the cap onto the jar when it is screwed down. The directorate of the company includes, besides the president, a number of local business men, including: J. B. Brannagan, general manager of the Western Wire Glass Company, Torrance, Cal., and formerly with the Macbeth-Evans Glass Company, Pittsburgh, Pa., and H. E. Charrey, president of the Midway Glass Company.

To take care of a steadily growing demand and repeat orders from foreign customers for Edward Miller glass working machinery, the **Miller Machine & Molds Works,** 717 Ann street, Columbus, O., are erecting a new building 40 ft. by 60 ft., to be used as a stock room for extra parts for the various machines that they now have on the market. This will materially better their service to customers in furnishing quick delivery of spare or repair parts that may be needed. This company has arranged with the British-Hartford-Fairmont Syndicate, 142-143 Audrey House, Elys Place, London, E. C. 1, England, to act as their agents for France, Belgium and Spain. This company already had the Miller agency for the British Isles. With them, as Edward Miller representatives, inquiries for the Edward Miller machines will be promptly taken care of when directed to either the London office or the home office at Columbus.

The controlling interest in the **Columbia Glass Company,** Fairmont, W. Va., which was established on a very small scale 17 years ago, by Antonio Scalise, for the manufacture of glass nest eggs, is reported to have been sold to new interests represented by Clarence D. Robinson, president of the Robinson coal interests and also president of the Fairmont Chamber of Commerce; M. A. Fletcher, treasurer of the Fairmont Trust Company; Glenn F. Barnes, secretary and treasurer of the Hite-Barnes Coal Company, and Oliver A. Wood, formerly manager of the Fairmont Window Glass Company. The company is chartered under West Virginia laws, and has an authorized capital of $150,000. The officers are: Glenn F. Barnes, president; M. A. Fletcher, vice-president; and Oliver A. Wood, secretary and treasurer. New lines were added to the company's output from time to time and at present a full line of opal glassware, cold cream jars, cheese containers, soap dishes, shaving mugs, bird baths, vases and many other articles included in opal glass goods is made. A subsidiary concern, the **Fairmont Stamping & Printing Works,** which manufactures metallic caps for bottles and jars, is making extensive improvements to its plant.

Industrial Publications

Walsh Fire Clay Products Company, St. Louis, Mo., have issued "Refractory Facts, a Handbook of Essential Information about Fire Clay Products," and a catalog of the Company's products, which include tank blocks, fire brick and other refractory materials. A substantial section of the book is devoted to discussing "the elementary principles of the rather new technology of fire clays." It will help to popularize the modern view of fire clay refractories. A short outline of chemistry written in a manner that enables even a non-technical reader to understand it, is included. Beginning with a description of matter, this chapter makes clear even to the reader who has not mastered the study of chemistry many of the elementary principles involved in the everyday activities of those engaged in making and using refractories. Some of the subjects briefly discussed are, the physical and chemical changes of matter, valence, atomic weights, acids and bases, vitrification, reducing and oxidizing flames, reducing atmosphere, combustion, gas producers, water gas machines and combined water.

The manufacture of refractories as carried on at the plants of the Walsh Company is described and illustrated with many interesting views. A special chapter is devoted to glass furnace material. The testing of refractory materials and various other subjects are taken up. At the back of the book are numerous tables selected with special reference to those interested in refractories.

Recent Deaths

John A. Voll

As announced on another page, the death of John A. Voll, president of the Glass Bottle Blowers' Association of the United States and Canada, occurred at Atlantic City very unexpectedly early in the morning of July 7.

A. R. Levis

Arthur R. Levis, associated with the Illinois Glass Company, at Alton, Ill., died on June 21, at his home in that city after a lingering illness. Mr. Levis, who was 34 years of age, was the son of R. H. Levis, vice-president and treasurer of the Illinois Glass Company. Besides his father, he is survived by his wife, two children and a brother, T. M. Levis.

C. J. Hoffman

C. J. Hoffman, 65 years old, president of the Tulsa Plate Glass Company, died July 2, at Tulsa, Okla.

Coming Meetings

The annual meeting of the **National Glass Distributors' Association** will be held in Pittsburgh, Pa., during December, 1924.

The **American Ceramic Society** annual meeting will be held at Columbus, O., February 16 to 21, inclusive, 1925.

The annual convention of the **American Bottlers of Carbonated Beverages** will be held at Louisville, Ky., November 10 to 14, inclusive.

The **Exposition of Inventions** will be held in the Engineering Societies Building, New York City, December 8 to 13, inclusive.

Inquiries Received

For further information address THE GLASS INDUSTRY.

210. (From France) We are interested in buying automatic machinery for the manufacture of lamp chimneys of all kinds and would like the names of manufacturers of such machinery. (July 10.)

211. Can you give us the names of manufacturers of semi-automatic glass blowing machines which might be adapted for blowing incandescent lamp bulbs? (July 17.)

212. We would like the names of manufacturers of 6 and 8 ounce drinking glasses who are equipped to etch a name on the glasses.

213. We are in the market for 150 ft. of gauge glass tubing in 3 or 5 ft. lengths in the following dimensions: ⅜ in. O. D. and ⅛ in. I. D., permissible variation in outside dimensions 1/64 in. over or under. (July 10.)

214. Kindly give us the name of a concern in or near New York City which will make a few molds for opal glass articles. (July 10.)

215. Would like the names of manufacturers of plate glass having small prisms or concentric rings cast on one side to prevent looking through it, but which allows plenty of light. (July 10.)

216. We are planning to increase our plant to four times its present capacity and would like to receive manufacturers' catalogs of modern equipment for making glass containers.

217. Kindly inform me where I can obtain glass paper weights for advertising purposes. (July 26.)

What the World Wants

Specific inquiries for American goods received in the Department of Commerce.

Numbers prefixed to the items refer to confidential information which may be obtained by concerns listed in the Exporters' Index by applying to the nearest district office of the Bureau of Foreign and Domestic Commerce, or to headquarters at Washington, D. C. Mention the number of the inquiry in which you are interested.

To become listed on the Exporters' Index, it is necessary to fill out a form (Form 57), which may be had upon application to the Bureau of its district or cooperative offices.

Belgium. 10875, culinary glass articles; 11118 glass tubes (water level indicators).

Persia. 10909, chemicals and glassware.

China. 11016, glass kerosene lamps, including brass burners, and wicks.

India. 11040, plate glass.

Cuba. 11084, bottles.

Peru. 11078, glassware.

Australia. 11,134, glassware,—tumblers, vases, dishes, lamp shades and globes.

Mexico. 11,177, bottles for perfumery and lotions or hair tonics and glass jars.

Stock Quotations

(Reported by Moore, Leonard & Lynch, Union Trust Bldg., Pittsburgh, Pa.)

PITTSBURGH STOCK EXCHANGE, JULY 24th, 1924

	Bid	Ask	Last
American Window Glass Machine, common	85	86	86
American Window Glass Machine, pfd.	..	94	94½
American Window Glass, preferred	108	110	109
Pittsburgh Plate Glass	235	..	240
U. S. Glass	17	22	18
Standard Plate Glass, common	31¾	32½	32¼
Standard Plate Glass, preferred.			
Cumulative	..	91	90
Prior	100½	..	100½

Manufacturers of all varieties of glass are confident of a better market before fall. Consumption, while not up to production, is sufficient to warrant continued operation and it is felt the small stock going into warehouses will move again very shortly.

Production of plate glass in the United States in 1924 will total ⅔ of the entire amount manufactured throughout the world in 1923. Figures for the first quarter show 22,005,629 square feet. The strength of plate glass is a reflection of the value of building construction awards which increased to $2,322,100,000 in the first half of 1924 compared to $2,109,000,000 in the same period last year. In one month only, May, was there any decline.

WHEELING STOCK EXCHANGE, JULY 24th, 1924

Hazel-Atlas	30	31	30½
Imperial Glass	80	85	90
Fostoria	145	150	150
Central Glass	..	110	108

The Wheeling issues ruled quiet and maintained the same price levels the past month. Hazel-Atlas which is operating at 85% of capacity dominated the market and closed at a decline of ½ point for the month.

TOLEDO STOCK EXCHANGE, JULY 24th, 1924

Owens Bottle Machine, common	44½	45	45
Libbey-Owens Sheet Glass, common	90	93	91½
Libbey-Owens Sheet Glass, preferred	108	..	..

Current Prices of Glass-Making Materials

Quotations furnished by various producers, manufacturers and dealers

July 24, 1924

	Carlots	Less Carlots
Aluminum hydrate ($Al(OH)_3$)...lb.	.05	.05½
Aluminum oxide (Al_2O_3).....lb.	.06½	.07
Antimony oxide (Sb_2O_3).....lb.	.08½	.09
Arsenic trioxide (As_2O_3) (dense white), 99%.....lb.	.08	.08½
Barium carbonate ($BaCO_3$) (precipitated).....ton	63.00	70.00
Barium hydrate ($Ba(OH)_2$).....lb.	.05	.05½
Bone ash.....lb.	.06½	.07½
Borax ($Na_2B_4O_7 10H_2O$).....lb.	.05	.05½
Borax, fused ($Na_2B_4O_7$) any mesh.lb.	.19	.20
Boric acid (B_2O_3), fused.....lb.	.35	.35
Cadmium Sulphide (CdS)—		
Red.....lb.	..	1.60
Orange.....lb.	1.50	1.65
Yellow.....lb.	..	1.80
Chrome Oxide (Cr_2O_3).....lb.	.35	.36
Cobalt Oxide (Co_3O_4)—		
In bbls.....lb.	..	2.10
In 10 lb. tins.....lb.	..	2.20
Copper oxide—		
Red (Cu_2O).....lb.	..	.20
Black (CuO).....lb.	..	.25
Black prepared.....lb.	..	.30
Cryolite (Na_3AlF_6).....lb.	..	.09⅝
Feldspar—		
100 mesh.....ton	14.00-21.00	16.00-25.00
80 mesh.....ton	15.00	18.00
40 mesh.....ton	12.50	15.50
Ferrous oxide (FeO).....lb.	..	..
Fluorspar (CaF_2)—		
Powdered white, 95%.....ton	35.00	..
Hydrofluoric acid (HF) 60% (in lead carboys).....lb.	..	.12
Kaolin (f.o.b. mine).....ton	9.00	12.00
Lead Oxide (Pb_3O_4) (red lead)...lb.	..	.10½
Litharge (PbO).....lb.	..	.10
Lime—		
Hydrated ($Ca(OH)_2$) (in 50 lb. paper sacks).....ton	12.50	..
Burnt (CaO) ground, in bulk.ton	9.00	..
Burnt, ground, in paper sacks.ton	11.00	..
Burnt, ground, in 280 lb. bbls. per bbl....	2.15	2.30
Magnesium carbonate ($MgCO_3$)...lb.	..	.08
Manganese 85% (MnO_2).....lb.	.03½	.03¾
Nickel oxide (Ni_2O_3), black, for nickel content.....lb.	.32	.45
Nickel monoxide (NiO), green, for nickel content.....lb.	.30	.50
Potassium carbonate—		
Calcined (K_2CO_3) 96%.....lb.	.05½	.06
Hydrated (KOH) 85%.....lb.	.06¾	.07
Potassium nitrate (KNO_3) (gran.).lb.	.06	.06¼
Potassium Permanganate ($KMnO_4$).....lb.	.14	.14½-.16
Powdered blue.....lb.	..	.24-.26
Standard formula.....lb.	..	.32
Salt cake, glassmakers (Na_2SO_4), f.o.b. works.....ton	23.00	30.00
Selenium (Se).....lb.	..	2.20-2.25
Soda ash (Na_2CO_3) dense, 58%— f. o. b. works.		
Bulk, spot.....Flat 100 lb.	1.40	..
Bulk, on contract....Flat 100 lb.	1.35	..
In 400 lb. bbls., on contract.100 lb.	1.69	2.40
In 400 lb. bags, on contract.100 lb.	1.45	2.16
Spot orders .05 per 100 lbs. higher.		
Sodium nitrate ($NaNO_3$), refined (Gran.) in bbls.....lb.	.04¼	.04½
Sodium selenite (Na_2SeO_3).....lb.	..	2.00
Sodium Fluosilicate (Na_2SiF_6)....lb.	..	.07½
Sulphur (S)—		
Flowers, 155 lb. bbl. Per 100 lb.	3.35	3.65-3.90
Flowers, in bags.....Per 100 lb.	3.00	3.30-3.55
Flour, heavy, in bbls..Per 100 lb.	2.50	2.80-3.05
Uranium oxide (UO_3), 100 lb lots.lb.	..	1.35
Zinc oxide (ZnO).....lb.	.08	.08¼

Monthly Summary of United States Foreign Commerce in Glass

Exports

Corrected to June 24, 1924

	May 1923 Quantity	May 1923 Value	May 1924 Quantity	May 1924 Value	Eleven Months Ending May 1923 Quantity	Eleven Months Ending May 1923 Value	Eleven Months Ending May 1924 Quantity	Eleven Months Ending May 1924 Value
Glass and glass products (total).....	.....	$922,551	.....	$800,283	.....	$8,800,948	.....	$9,062,311
Plate and window glass—								
Window glass, common, box 50 sq. ft.....	4,700	25,468	6,119	24,741	32,680	185,463	46,674	207,573
Plate glass, unsilvered, sq. ft.....	232,225	90,609	172,923	41,759	2,059,561	810,753	1,511,454	564,103
Other window and plate glass, n.e.s.....lbs.	246,844	29,237	88,905	14,727	2,867,294	366,089	2,102,409	236,594
Glass containers (bottles, vials and jars).....lbs.	6,913,169	328,724	5,766,542	302,831	53,993,853	2,712,253	59,053,804	2,872,250
Table glassware, plain.....lbs.	1,541,472	178,926	1,166,868	145,728	16,807,193	1,766,964	16,820,021	1,891,828
Table and other glassware, cut or engraved....lbs.	64,990	25,275	45,452	15,628	542,563	207,480	483,083	158,991
Glass for lighting—								
Lamp chimneys and lantern globes.....lbs.	155,363	29,102	198,177	34,282	1,467,434	286,136	1,842,400	348,532
Globes and shades for lighting fixtures.....lbs.	121,147	34,538	104,443	44,661	1,399,364	401,755	1,518,448	435,377
Lamps and other illuminating devices, chiefly of glass.....lbs.	92,440	26,517	72,714	15,390	1,141,795	333,543	1,273,079	326,850
Chemical glassware.....lbs.	16,389	11,204	16,537	14,162	191,230	131,650	231,105	166,485
Electrical glassware, except for lighting.....lbs.	281,037	16,012	196,490	17,134	2,830,544	179,692	2,359,512	195,687
Other glassware, n.e.s.....lbs.	981,133	126,939	599,287	129,240	8,684,568	1,479,170	10,241,320	1,658,041

Imports

Corrected to June 24, 1924

	May 1923 Quantity	May 1923 Value	May 1924 Quantity	May 1924 Value	Eleven Months Ending May 1923 Quantity	Eleven Months Ending May 1923 Value	Eleven Months Ending May 1924 Quantity	Eleven Months Ending May 1924 Value
Glass (total).....	.....	$2,160,005	.....	$1,980,187	.....	$17,086,167	.....	$22,447,718
Cylinder, crown, and sheet lbs.—								
Unpolished, lbs.....dut.	7,280,177	345,296	2,905,990	157,135	46,185,467	2,024,997	32,142,349	1,678,651
Bent, ground, beveled, colored, painted, etc. and polished.....dut.	.....	92,262	.....	36,312	.....	[2]504,971	.....	655,835
Plate glass—								
Unsilvered, sq. ft.....dut.	2,098,361	1,222,847	2,010,356	1,287,387	17,172,832	9,060,020	23,024,585	14,751,593
Fluted, rolled, etc., or silvered, or containing wire netting, sq. ft.....dut.	199,715	27,767	278,904	35,689	[1]1,385,725	[2]251,451	2,246,180	325,412
Containers—bottles, vials, etc.....dut.	.....	11,918	.....	28,234	.....	293,960	.....	176,335
Table and kitchen utensils, lbs.....dut.	27,590	8,102	58,782	14,907	[2]518,189	[3]186,759	747,482	160,415
Glassware, cut or decorated, lbs.....dut.	453,343	147,461	324,829	134,196	.....	1,511,853	3,402,284	1,508,232
Blown glassware, n. e. s., lbs.....dut.	598,957	142,990	.....	.....	[3]3,819,975	[3]844,336	[3]3,402,894	[3]881,319
Bottles, ornaments, etc., lbs.....dut.	.....	.....	242,314	81,359	.....	.....	[4]1,162,405	[4]413,167
Bulbs or electric lamps, lbs.....dut.	.....	.....	664,260	15,473	.....	.....	[4]3,088,637	[4]62,655
Chimneys, globes, shades, etc., lbs.....dut.	.....	.....	498,959	85,335	.....	.....	[4]1,894,702	[4]308,128
Articles and utensils for chemical, scientific, and experimental purposes, lbs.....dut.	.....	.....	146,461	36,140	.....	.....	[4]392,165	[4]135,060
Other glassware.....free	.....	.....	.....	.....	[1]44,483	[1]44,253	.....	.....
dut.	.....	161,362	.....	68,020	.....	2,363,567	.....	1,390,916

[1]July to Sept. 21, 1922. [2]Beginning Sept. 22, 1922. [3]July 1 to Dec. 31, 1923. [4]Beginning Jan. 1, 1924.